
Work Order No. 03917.008.013

**No. 2 Recovery Boiler
Particulate Matter and Total Reduced Sulfur
Emission Compliance Test Report
Bowater Incorporated
Catawba, South Carolina
23 July 2008**

Prepared For

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SECTION 1 INTRODUCTION

Weston Solutions, Inc. (WESTON[®]) was retained by Bowater Incorporated (Bowater) to conduct particulate matter (PM) and total reduced sulfur (TRS) emission testing on the No. 2 Recovery Boiler (RB) at the mill in Catawba, South Carolina. The purpose of the testing was to demonstrate compliance with the South Carolina Department of Health and Environmental Control (DHEC) permit limits.

WESTON performed the emission testing on 23 July 2008. The project team included the following individuals.

Name	Project Role
Templeton Simpkins	Project Manager/Test Team Leader
Melanie Wright	Quality Assurance Manager
Mark Fowler	Test Team Member
Robert Griffin	Test Team Member
Natalie Hornsby	Report Coordinator

Mr. Will Hinson of Bowater coordinated the testing with mill operations and served as WESTON's technical contact throughout the effort. A representative of DHEC was not present during the testing.



SECTION 2 RESULTS AND DISCUSSION

Tables 2-1 and 2-2 provide detailed summaries of the emission results with comparison to the permit limits. The results are less than the applicable standard for the source. Any differences between the calculated results presented in the appendices and the results reported in the summary tables are due to rounding for presentation.

**TABLE 2-1
NO. 2 RECOVERY BOILER
SUMMARY OF PM EMISSION RESULTS**

	Run 1	Run 2	Run 3	Mean
Date	7/23/08	7/23/08	7/23/08	----
Time Began	0952	1149	1415	----
Time Ended	1058	1255	1523	----
Stack Gas Data				
Temperature, °F	341	341	341	341
Velocity, ft/sec	49	49	50	49
Moisture, %	25	27	26	26
CO ₂ Concentration, %	14.1	14.3	14.2	14.2
O ₂ Concentration, %	5.2	5.0	5.0	5.1
VFR, x 10 ⁴ dscfm	10.1	9.95	10.3	10.1
Production Rate, ADTP/hr	26.6	26.6	26.6	26.6
Particulate Matter				
Isokinetic Sampling Rate, %	101	103	100	101
Concentration, gr/dscf	0.008	0.009	0.005	0.007
Concentration, gr/dscf @ 8%	0.006	0.007	0.004	0.006
Emission Rate, lb/hr	6.8	7.4	4.4	6.2
Emission Factor, lb/ADTP	0.255	0.278	0.164	0.232
Permit Limit, lb/ADTP	----	----	----	2.75

TABLE 2-2
NO. 2 RECOVERY BOILER
SUMMARY OF TRS EMISSION RESULTS

	Run 1	Run 2	Run 3	Mean
Date	7/23/08	7/23/08	7/23/08	----
Time Began	0952	1150	1522	----
Time Ended	1121	1320	1654	----
Stack Gas Data				
Temperature, °F	341	341	341	341
Velocity, ft/sec	49	49	50	49
Moisture, %	25	27	26	26
CO ₂ Concentration, %	14.1	14.3	14.4	14.3
O ₂ Concentration, %	5.2	5.0	4.9	5.0
VFR, x 10 ⁴ dscfm	10.1	9.95	10.3	10.1
Total Reduced Sulfur				
Concentration, ppm	9.73	7.74	13.1	10.2
Concentration, ppm @ 8% O ₂	8.01	6.29	10.6	8.29
Permit Limit, ppm @ 8% O₂	----	----	----	20



SECTION 3

SOURCE TESTING METHODOLOGY

The emission testing program was conducted in accordance with the U.S. EPA Reference Methods summarized in Table 3-1. Method descriptions and quality assurance data are provided in the referenced appendices.

TABLE 3-1
SOURCE TESTING METHODOLOGY

Parameter	Method Number	Appendix Reference		Comments
		Method Description	Quality Control Data	
Volumetric Flow Rate	1,2,3,4	B.1	D	
Gas Composition	3A	B.2	D	
Particulate Matter	5	B.3	D	
Total Reduced Sulfur	16	B.4	D	

Integrated bag samples were collected during PM sampling at the Recovery Boiler and analyzed on the calibrated O₂/CO₂ analyzers.

Post-test equipment calibrations for the probe and pitot will be maintained on file at WESTON.



APPENDIX A

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

No. 2 Recovery Boiler

Meter Pressure (Pm), in. Hg

$$P_m = P_b + \frac{\Delta H}{13.6 \text{ in. } H_2O/\text{in. } Hg}$$

where, Pb = barometric pressure, in. Hg
 ΔH = Pressure differential of orifice in. H_2O

Absolute Stack Gas Pressure (Ps), in. Hg

$$P_s = P_b + \frac{P_g}{13.6 \text{ in. } H_2O/\text{in. } Hg}$$

where, Pb = barometric pressure, in. Hg
Pg = Static Pressure, in. H_2O

Standard Meter Volume (Vmstd), dscf

$$V_{mstd} = \frac{17.64 \text{ } ^\circ R/\text{in. } Hg \times Y \times V_m \times P_m}{T_m}$$

where, Y = meter correction factor
Vm = meter volume, cf
Pm = meter pressure, in. Hg
Tm = meter temperature, $^\circ R$

Standard Wet Volume (Vwstd), scf

$$V_{wstd} = 0.04707 \text{ ft}^3/\text{mL} \times V_{lc}$$

where, V_{lc} = volume of H_2O collected, mL

Moisture Fraction (Measured), (Bws)

$$B_{ws} = \frac{V_{wstd}}{(V_{wstd} + V_{mstd})}$$

where, V_{wstd} = standard wet volume, scf
 V_{mstd} = standard meter volume, dscf

Moisture Fraction (at saturation), (Bws)

$$Bws = \frac{Vp}{Ps}$$

where, Vp = vapor pressure of H_2O at stack gas temp., in. Hg
 Ps = absolute stack gas pressure, in. Hg

Moisture, %

$$Moisture = Bws \times 100$$

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O_2) + (0.28(100 - \% CO_2 - \% O_2))$$

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md (1 - Bws) + 18(Bws)$$

where, Md = molecular weight (DRY), lb/lb-mole
 Bws = moisture fraction, dimensionless

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \frac{ft}{sec} \sqrt{\frac{(lb/lb - mole)(in. Hg)}{(^oR)(in. H_2O)}} \times Cp \times \sqrt{\Delta P \text{ avg.}} \times \sqrt{\frac{T_s}{Ps \times Ms}}$$

where, Cp = pitot tube coefficient
 ΔP = velocity head of stack gas, in. H_2O
 T_s = absolute stack temperature, oR
 Ps = absolute stack gas pressure, in. Hg
 Ms = molecular weight of stack gas, lb/lb-mole

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \text{ sec/min} \times Vs \times As$$

where, Vs = stack gas velocity, ft/sec
 As = cross-sectional area of stack, ft^2

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.64 \frac{^oR}{in. Hg} \times Qa \times (1 - Bws) \times \frac{Ps}{T_s}$$

where, Qa = average stack gas flow at stack conditions, ft^3/min
 Bws = moisture content (dimensionless)
 Ps = absolute stack gas pressure, in. Hg
 T_s = absolute stack temperature, oR

Percent Isokinetic Sampling Rate (%I)

$$\% I = \frac{0.0945(\text{in. Hg})(\text{min})/(\text{°R})(\text{sec}) \times T_s \times V_{mstd}}{P_s \times V_s \times A_n \times \Theta \times (1 - B_{ws})}$$

where,
 Ts = avg. stack temperature, °R
 Vmstd = standard meter volume, dscf
 Ps = absolute stack gas pressure, in. Hg
 Vs = stack gas velocity, ft/sec
 An = cross-sectional area of nozzle, ft²
 Θ = total sampling time, min
 B_{ws} = moisture content (dimensionless)

Particulate Matter Concentration at Standard Conditions (Cs), gr/dscf

$$Cs = 15.43 \frac{gr}{g} \times \frac{Mn}{V_{mstd}}$$

where,
 Mn = particulate matter collected, g
 Vmstd = std. meter volume, dscf

Particulate Matter Concentration Corrected for O₂, Cs @ 8% O₂

$$Cs, \frac{gr}{dscf} \times \frac{20.9 - 8\% O_2}{20.9 - \text{measured \% } O_2}$$

Particulate Matter Emission Rate (PMR), lb/hr

$$PMR = \frac{Cs \times Q_s \times 60 \frac{\text{min}}{\text{hr}}}{7000 \frac{\text{gr}}{\text{lb}}}$$

where,
 Cs = particulate conc. at std. cond., gr/dscf
 Qs = avg. stack gas flow at std. cond., dscf/min

Particulate Matter Emission Factor, lb/ADTP

$$ER = \frac{\text{Emission Rate, lb/hr}}{\text{Production Rate, ADTP/hr}}$$

Total Reduced Sulfur Concentration Corrected for Recovery, ppm

$$= \left(\frac{\text{Measured Concentration, ppm}}{\% \text{ Recovery}} \right) \times 100$$

Total Reduced Sulfur Concentration Corrected to 8% O₂, ppm @ 8% O₂

$$= \text{Recovery Corrected Concentration, ppm} \times \left(\frac{21 - 8}{21 - \text{Measured O}_2} \right)$$

Total Reduced Sulfur Emission Rate, lb/hr

$$ER = \frac{\text{TRS conc.} \times \text{MW} \times Q_s \times 60 \frac{\text{min}}{\text{hr}} \times 28.32 \frac{\text{L}}{\text{dscf}}}{24.04 \frac{\text{L}}{\text{g - mole}} \times 1.0 \times 10^6 \times \frac{\mu\text{L}}{\text{L}} \times 454 \frac{\text{g}}{\text{lb}}}$$

Total Reduced Sulfur Emission Factor, lb/ADTP (EF)

$$EF = \frac{\text{lb/hr}}{\text{ADTP/hr}}$$



APPENDIX B

TEST METHODOLOGY

- B.1 VOLUMETRIC FLOW RATE**
- B.2 GAS COMPOSITION**
- B.3 PARTICULATE MATTER**
- B.4 TOTAL REDUCED SULFUR**

B.1 VOLUMETRIC FLOW RATE

Mass emission rates are calculated by multiplying measured target analyte concentrations by calculated volumetric flow rates. Volumetric flow rates are calculated using measurement data obtained by EPA Reference Methods 1-4.

The ductwork is measured at the sample location to the nearest 0.25 inch using a steel tape measure. Traverse points are selected in accordance with EPA Reference Method 1 on the basis of ductwork dimensions, geometry, and upstream and downstream disturbances. When a sample location does not meet EPA Reference Method 1 criteria, the maximum recommended number of traverse points is used.

Gas Velocity

The velocity of the gas stream is measured in accordance with EPA Reference Method 2 by reading the instantaneous velocity pressure with an inclined manometer at each traverse point using either a standard "P" type or an "S" type pitot tube. The stack pressure is calculated from the measured static pressure of the stack and the ambient barometric pressure. The static pressure is measured by using the static side of the pitot tube, and the barometric pressure is measured using a calibrated aneroid barometer. Magnahelic® gauges with scales of 0 to 5 and 0 to 25 inches of water or an inclined manometer with a scale of 0 to 10 inches of water are used for velocity pressure measurements. Manometer selection is determined by the velocity pressure of the gas stream. A manometer with a 0 to 0.25 inch scale may be used when the velocity pressure of the gas stream is less than 0.02 inches of water. By convention, any measured velocity pressures of less than 0.005 inches of water are recorded and reported as less than 0.005 inches of water. The stack temperature is measured with a calibrated thermocouple and pyrometer.

For low velocity pressure measurements (less than 0.005 inches of water) a hot wire anemometer may be used to measure the velocity of the gas stream. The indicated velocity is used without correction when the gas stream is ambient air with a moisture content of less than 65%. The indicated velocity is corrected in accordance with procedures specified by the manufacturer when the moisture content exceeds 65% or when the dry gas fraction is something other than ambient air.

Gas Composition and Moisture Content

The composition of the gas stream is measured in accordance with EPA Reference Method 3A using an analyzer.

Integrated samples are collected by withdrawing a sample from the source through a moisture condenser into a Tedlar® sample bag. The bag is then analyzed using a calibrated O₂/CO₂ analyzer.

The moisture content of the gas stream is determined using one of the following procedures:

- For sources requiring testing by EPA Reference or Test Methods 5, 8, 12, 13, 17, 23, 26A, 29, 0010, or 0011, moisture is determined by EPA Reference Method 4. At the conclusion of each run the volume of condensed moisture in the impingers of the sampling train is measured and used to calculate the moisture content of the gas stream.
- For sources with temperatures greater than 212 °F, the approximation technique described in EPA Reference Method 4 may be used with midget impingers to condense moisture before dry gas volume measurement.
- For sources with a temperature of less than 212 °F, wet bulb/dry bulb temperature measurements may be made, and the moisture content calculated using vapor pressure tables.

When multiple methods are used for moisture determinations, the lowest moisture value is used for volumetric flow calculations.

The molecular weight of the gas stream is calculated using the measured moisture, oxygen, and carbon dioxide concentrations. The balance of the gas stream is assumed to be nitrogen. The volumetric flow is then calculated at stack and standard conditions using the calculated molecular weight, the measured stack temperature, and measured velocity, stack and barometric pressures. Standard conditions are 68 °F and 29.92 inches of mercury and 0% moisture.

Data Acquisition and Reporting

Data are recorded at the time of collection on preprinted data sheets. Calculations are performed (where possible) with preprogrammed calculators or spreadsheet software.

Quality Control

Quality control procedures for volumetric flow measurements involve leak checks of pitot tubes, pitot tube lines and manometers; periodic analysis of ambient air and duplicate analysis of source gas samples with the Fyrite analyzer; triplicate analysis with the Orsat analyzer; and periodic calibration checks of thermocouples and pyrometers.

Data transfers are minimized. Data sheets are checked for completeness and accuracy. Calculations are verified by a second person.

B.2 GAS COMPOSITION (INSTRUMENTAL)

Oxygen (O_2) and carbon dioxide (CO_2) testing is conducted in accordance with EPA Reference Method 3A.

Sampling Equipment and Procedures

Figure B-1 illustrates the sampling system. The sample is withdrawn continuously from the source through a heated probe, filter, and sample line to a sample conditioner which removes moisture from the gas stream. The sample is then transported to a California Analytical Model 300 O_2 analyzer and a California Analytical Model 300 CO_2 analyzer.

Sample Analysis

The O_2 analyzer uses an electrochemical cell or paramagnetic detector and the CO_2 analyzer uses a non-dispersive infra-red (NDIR) detector to produce an electrical signal which is linearly proportional to the O_2 and CO_2 concentration, respectively.

Data Acquisition and Reduction

Data is acquired electronically using an IBM compatible computer and software designed by WESTON for EPA Reference Method 3A analysis. This system generates a calibration curve, converts electronic signals into concentrations, and provides one-minute averages during the sample run and an average concentration over the duration of the sample run.

Quality Control

At the time of analysis, O_2 and CO_2 in nitrogen calibration gases certified according to EPA Protocol-1, are used to calibrate the analyzer and to determine a bias correction factor for the entire system bias in accordance with EPA Reference Method 3A. The calibration gases are introduced directly to the analyzer to generate the calibration curve. A zero gas and an upscale calibration gas is introduced at the probe and recovered through the sampling and analytical system. A bias correction factor is calculated using the ratio of the concentration measured from the sampling system and concentration measured directly at the analyzer. Sample run averages are corrected for system bias results.

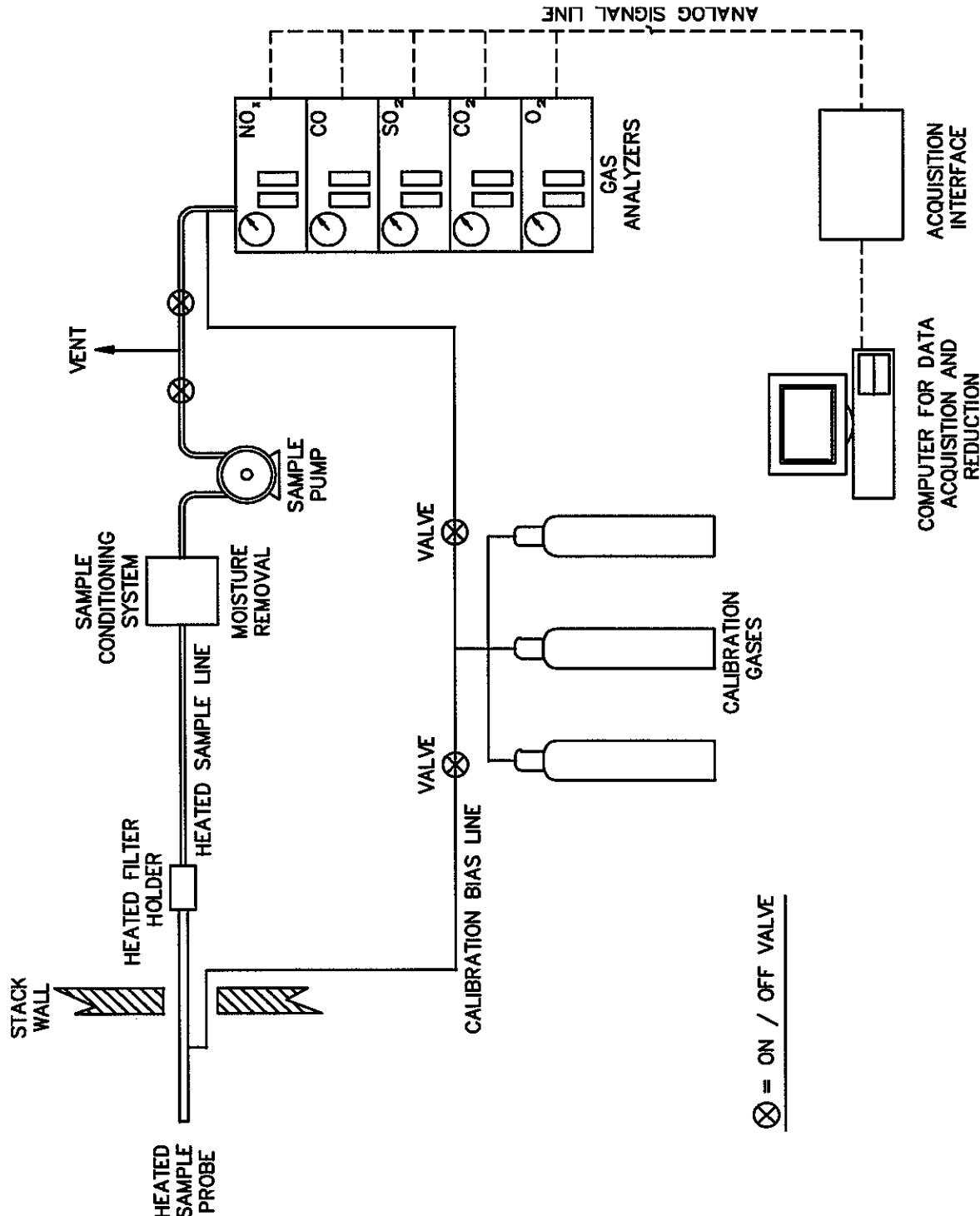


Figure B-1 Continuous Emission Monitoring System

B.3 PARTICULATE MATTER

Particulate matter (PM) emission testing is conducted using EPA Reference Method 5. EPA Reference Methods 1-4 are used, as appropriate, for traverse point selection, determination of stack gas molecular weight, stack gas moisture determination, and volumetric flow rate.

Sampling Equipment and Procedures

The sampling train utilized to perform the PM sampling is an EPA Reference Method 5 train manufactured by Graseby-Nutech, Graseby-Anderson, or Apex Instruments (see Figure B-2). A measured borosilicate, quartz glass, or stainless steel (316) nozzle is attached to a heated (248 ± 25 °F) borosilicate or quartz glass, or stainless steel probe of appropriate length. The probe is connected to a heated (248 ± 25 °F) borosilicate glass filter holder containing a 9-cm glass fiber filter (preweighed to a constant 0.1 mg weight). The first and second impingers each contain 100 mL of distilled water, the third impinger is empty, and the fourth impinger contains 200 to 300 grams of dry preweighed silica gel. The second impinger is a standard Greenburg-Smith type. The first, third, and fourth impingers are of a modified design. All impingers are maintained in a crushed ice bath. A gas measuring control console with a leak-free vacuum pump, a calibrated dry gas meter, a calibrated orifice, and inclined manometers are connected to the final impinger, probe, heated filter holder, and pitot tube via an umbilical cord to complete the train.

Flue gas velocity is measured with a calibrated S-type pitot tube (provided with extensions) fastened alongside the sampling nozzle. Flue gas temperature is monitored with a calibrated direct readout pyrometer equipped with a chromel-alumel (Type K) thermocouple positioned near the sampling nozzle. The probe, filter box, and impinger exit gas temperatures are monitored with a calibrated direct readout pyrometer equipped with Type K thermocouples positioned in the probe, heated filter chamber, and in the sample gas stream after the last impinger. Stack gas stream composition (carbon dioxide and oxygen content) is determined as previously described. The sampling rate is adjusted, based on stack velocity, at each point to ensure the sample is collected isokinetically.

At the conclusion of each test, the sampling train is leak checked. Upon completion of a successful leak check, the sampling train is dismantled, openings are sealed, and the components recovered as described below.

- The glass fiber filter(s) is/are removed from its holder with tweezers and placed in its original container, along with any particulate and filter fragments (Sample Fraction 1).

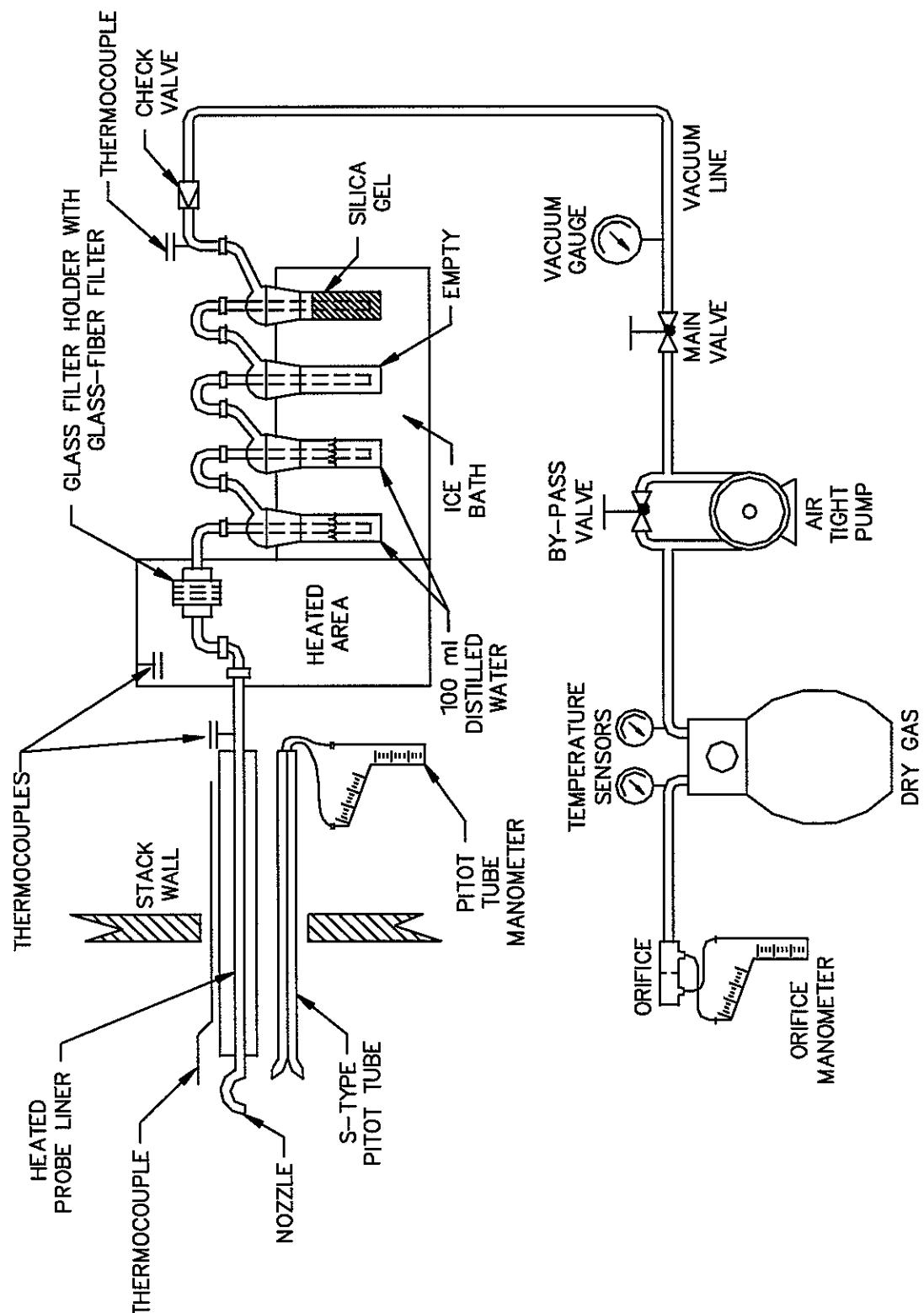


Figure B-2 EPA Reference Method 5 Sampling Train

- The probe and nozzle are separated and the particulate rinsed with distilled water or acetone into a polyethylene container while brushing a minimum of three times. Particulate adhering to the brush is rinsed with the appropriate solvent into the same container. The front half of the filter holder and connecting glassware are also rinsed. These rinses are combined (Sample Fraction 2).
- The total liquid content of impingers one, two, and three are measured volumetrically for stack gas moisture content calculation. This liquid is discarded.
- The silica gel is removed from the last impinger and immediately weighed to the nearest 0.1 g for stack gas moisture content calculation.
- Aliquots of the appropriate solvents and a filter are retained for blank analyses.

Each sample bottle is labeled to clearly identify its contents. The liquid level is marked on each bottle. The samples are then secured for transport to a laboratory for analysis. Sample integrity is assured by maintaining chain-of-custody records.

Sample Analysis

The particulate analysis proceeds as follows:

- The sample filters (Sample Fraction 1) and blank filter are desiccated for 24 hours and weighed to the nearest 0.1 mg to constant (± 0.5 mg) weight.
- The nozzle, probe, and front half of the filter holder wash samples (Sample Fraction 2), along with the solvent blank, are evaporated in tared beakers, then desiccated and weighed to the nearest 0.1 mg to constant (± 0.5 mg) weights.

The total weight of material measured in the front half wash in addition to the weight of material collected on the glass fiber filter represent the total PM catch for each train. Blank corrections are made where appropriate for all sample weights.

Data Acquisition and Reduction

Data are recorded at the time of collection on preprinted data sheets. Calculations are performed with preprogrammed calculators or spreadsheet software. Data transfers are minimized. Field and laboratory data sheets are checked for completeness and accuracy. Calculations are verified by a second person.

Quality Control

Dry gas meters are calibrated before and after sampling. Thermocouples are calibrated against mercury thermometers, and aneroid barometers are calibrated against a mercury barometer. WESTON participated satisfactorily in the most recent dry gas meter audit supplied by the EPA. Those data are on file at WESTON.

Prior to and following each run, the sampling train is leak checked. An acceptable leak rate does not exceed the lesser of 0.02 actual cubic feet per minute (acf m) or 4% of the actual sampling rate. The isokinetic sampling rate is calculated at the completion of each sample run. If the isokinetic sampling rate is not within $100\% \pm 10\%$, the sample run is repeated.

Samples are transported to the laboratory under chain-of-custody. Solvent blanks and filter blanks are analyzed at the same time as the samples. The mass collected on the filters and the mass in the probe wash are corrected by the blank measurements.

WESTON uses Class S weights during each stage of the analysis to verify the accuracy of the balance. The balance is repaired and recalibrated before proceeding if there is a significant difference in the actual mass and measured mass.

B.4 TOTAL REDUCED SULFUR

Total reduced sulfur testing is performed using the procedures described in EPA Reference Method 16. When TRS data must be oxygen corrected, EPA Reference Method 3 using an Orsat analyzer, is performed on an integrated bag sample to measure oxygen concentration.

Sampling Equipment and Procedures

Figure B-3 illustrates the sampling system. A Teflon®-lined, stainless steel probe of sufficient length to monitor the gas stream (without wall effects) is used to extract a gas sample from the emission source. The probe tip is directed away from stack gas flow to minimize particulate and moisture entrainment. The probe is connected directly to the recovery gas line and sample conditioning system.

The sample conditioning system consists of a Teflon® impinger containing 1.5M citrate buffer, adjusted to a pH of 5.4 to 5.8, maintained in an ice bath. Moisture is condensed in the impingers, yielding a dry sample and thus eliminating the need for heated sample lines. Even though the impinger set traps entrained particulate matter, very fine particulate matter is removed by a Balston® AQ Microfiber filter installed at the impinger outlet.

An unheated nylon line is connected from the filter to the sample pump inlet. Sample line length and connections are minimized to reduce surface adsorption of TRS and the possibility of leaks.

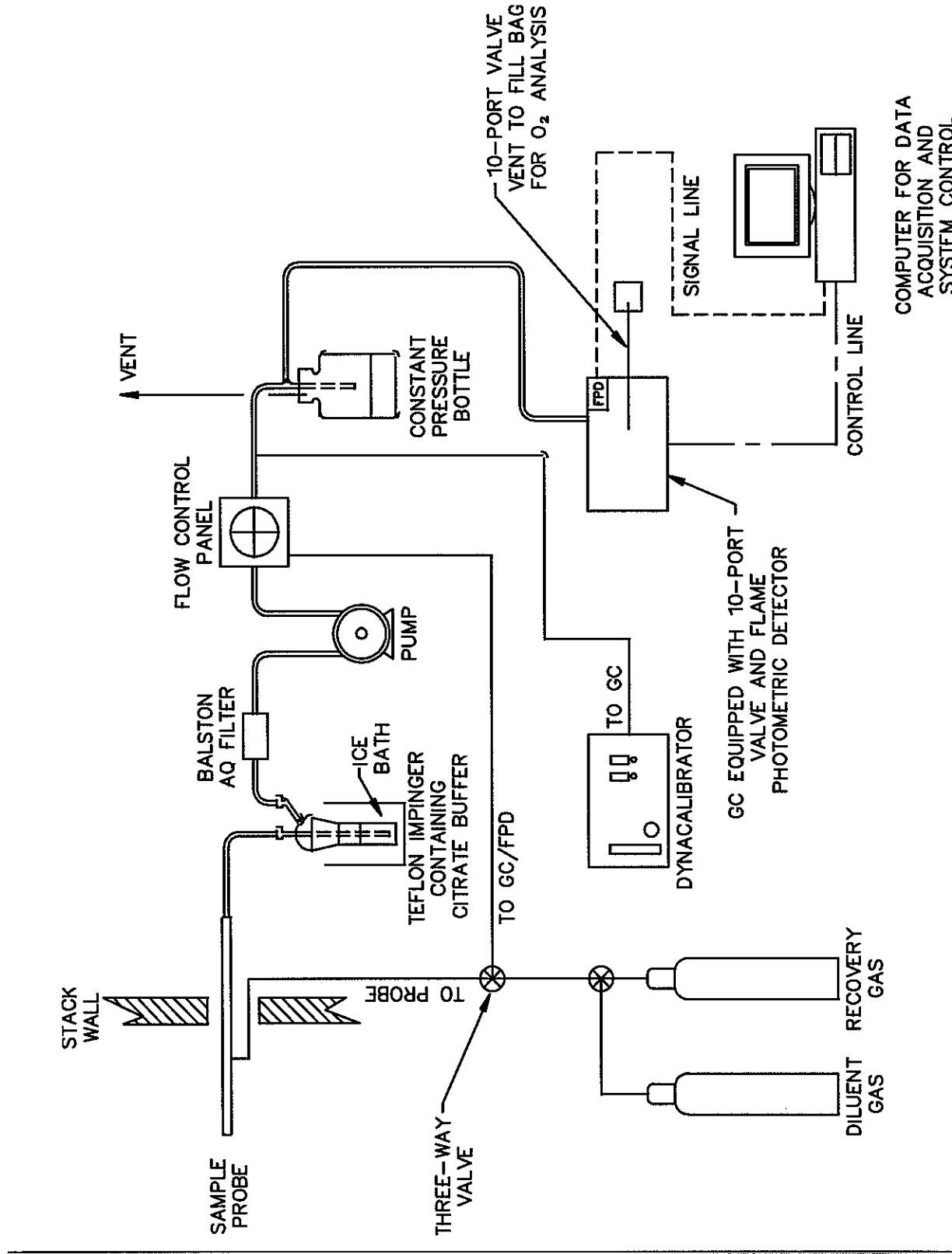


Figure B-3 EPA Reference Method 16 Sampling and Analytical Train

The pump outlet is connected directly to a constant pressure bottle. At this point, a major portion of the sample is vented to the atmosphere, and the remainder is used to charge the gas chromatograph (GC) sample loop. The GC sample loop outlet is connected to a Tedlar® gas collection bag gas sample collection and subsequent analysis using an Orsat apparatus.

Sample Analysis

Separation of hydrogen sulfide (H_2S), methyl mercaptan (MeSH), dimethyl sulfide (DMS), and dimethyl disulfide (DMDS) is accomplished by gas chromatography on a SPB1 Capillary column. After resolution of H_2S , MeSH, and DMS, the Capillary column is backflushed to achieve resolution of DMDS within 2-3 minutes from sample injection. The gas chromatograph is operated on periodic cycle to produce a minimum of ten injections per hour.

Detection of reduced sulfur compounds is accomplished with a flame photometric detector (FPD). The FPD response is calibrated before and after every three hours of testing, using gas phase standards prepared from gravimetrically certified permeation devices.

Data Acquisition and Reduction

The FPD responses are recorded by an IBM compatible computer equipped with software designed by WESTON for reduced sulfur compound analysis. The software controls the timing of the gas-chromatographic cycle, integrates and records peaks, performs calculations, and prints the results. Calibration curves are generated by the software using log-log linear least squares best fit of the data.

Quality Control

Permeation devices certified by the vendor are used to calibrate the FPD response. The temperature of the devices is maintained at a constant value (as certified by vendor) to ensure a constant, accurate permeation rate. The temperature of the permeation chamber is verified at the time of sampling with an National Institute of Standards and Technology (NIST) traceable mercury-in-glass thermometer. The temperature of the permeation chamber is maintained at 50.0 ± 0.1 °C throughout the sampling.

VICI-Metronics, Santa Clara, California, supplied the permeation devices for the testing. The devices are gravimetrically analyzed to measure the emission rate before shipment.

Various concentrations of the permeants are generated by varying the flow of the diluent gas stream over the devices. A calibration curve is constructed of at least three concentrations of each permeant; three successive injections at each concentration yield peak areas that differ from the mean peak area value by less than 5%.

Sampling system integrity is evaluated after every three hours of sampling by injecting a low concentration of H₂S at the probe tip and recovering the sample through the sample conditioning and sample transport subsystems. The same gas stream is then introduced directly to the GC sample loop. The ratio of concentrations corresponds to the system correction factor. This factor is then used to adjust measured reduced sulfur compound concentrations.

A system audit gas (of appropriate H₂S concentration) is used to evaluate the analytical system integrity each test day. Audit gas results will be within 10% of the certified cylinder concentration.



APPENDIX C
FIELD DATA – NO. 2 RECOVERY BOILER



PARTICULATE MATTER

Bowater
Catawba, SC

03917.008.013
No. 2 Recovery Furnace

ISOKINETIC CALCULATIONS

Run Number		1	2	3	Mean
Date		7/23/2008	7/23/2008	7/23/2008	---
Time Began		952	1149	1415	---
Time Ended		1058	1255	1523	---
INPUT DATA					
Sampling Time, min	(Theta)	64.0	64	64	64
Stack Diameter, in.	(Dia.)	114.75	114.75	114.75	114.75
Barometric Pressure, in. Hg	(Pb)	29.29	29.29	29.29	29.29
Static Pressure, in. H2O	(Pg)	-0.40	-0.40	-0.40	-0.40
Pitot Tube Coefficient	(Cp)	0.84	0.84	0.84	0.84
Meter Correction Factor	(Y)	0.9960	0.9960	0.9960	0.9960
Orifice Calibration Value	(Delta H@)	1.9360	1.9360	1.9360	1.9360
Nozzle Diameter, in.	(Dn)	0.270	0.270	0.270	0.270
Meter Volume, ft^3	(Vm)	38.592	38.999	40.114	39.235
Meter Temperature, °F	(Tm)	90.4	93.0	103.7	95.7
Meter Temperature, °R	(Tm-R)	550.4	553.0	563.7	555.7
Meter Orifice Pressure, in. H2O	(Delta H)	1.200	1.220	1.294	1.238
Ave Sq Rt Orifice Press, (in. H2O)^½	((Delta H)½)avg	1.100	1.100	1.130	1.110
Volume H2O Collected, mL	(Vlc)	261.1	285.3	276.1	274.2
CO2 Concentration, %	(CO2)	14.1	14.3	14.2	14.2
O2 Concentration, %	(O2)	5.2	5.0	5.0	5.1
Ave Sq Rt Velo Head, (in. H2O)^½	((Delta P)½)avg	0.680	0.680	0.700	0.687
Stack Temperature, °F	(Ts)	340.9	341.1	340.9	341.0
Stack Temperature, °R	(Ts-R)	800.9	801.1	800.9	801.0
Particulate Collected, g	(Mn)	0.0183	0.0204	0.0117	0.0168
Moisture Fraction (at Saturation)	(BWS)	NA	NA	NA	NA
Production Rate, ADTP/hr	(Pr)	26.60	26.56	26.59	26.58
CALCULATED DATA					
Nozzle Area, in²	(An)	0.0572555	0.0572555	0.0572555	0.06
Stack Area, ft²	(As)	71.82	71.82	71.82	71.82
Stack Pressure, in. Hg	(Ps)	29.26	29.26	29.26	29.26
Meter Pressure, in. Hg	(Pm)	29.38	29.38	29.39	29.38
Standard Meter Volume, ft³	(Vmstd)	36.191	36.403	36.740	36.444
Standard Water Volume, ft³	(Vwstd)	12.290	13.429	12.996	12.905
Moisture Fraction (Measured)	(BWS)	0.254	0.269	0.261	0.261
Moisture Fraction (lower sat/meas)	(BWS)	0.254	0.269	0.261	0.261
Mol. Wt. of Dry Gas, lb/lb-mole	(Md)	30.46	30.49	30.47	30.47
Mol. Wt. of Stack Gas, lb/lb-mole	(Ms)	27.30	27.12	27.21	27.21
Average Stack Gas Velocity, ft/sec	(Vs)	48.89	49.06	50.41	49.46
Stack Gas Flow, actual, ft³/min	(Qa)	210684	211415	217244	213115
Stack Gas Flow, Std , ft³/min	(Qs)	101360	99508	103423	101430
Isokinetic Sampling Rate, %	(%I)	100.8	103.3	100.3	101.4
Particulate Conc @ Std Cond, gr/ft³	(Cs)	0.008	0.009	0.005	0.007
Particulate Conc @ % O2, gr/ft³	8 (Cs @ 8%)	0.006	0.007	0.004	0.006
Particulate Emission, lb/hr	(PMR)	6.777	7.374	4.355	6.17
Particulate Emission Factor, lb/ADTP	(Pr)	0.255	0.278	0.164	0.232
Calibration check	(Yqa)	0.9889	0.9805	0.9888	0.986
Percent difference from Y					-1.00%

NP
JG
B
JG

CLIENT
WESTON W.O. No.
Date Received
Analyst

Balance ID: Mettler AE163
Density of Acetone (g/mL): 0.7848
Lab Ambient Temp (F): 68.7
Lab Rel Humidity (%): 48
Barometric Pressure (Hg): 29.29

Source	ONE	TWO	THREE	FIELD BLANK
Field Run No.				
LIQUID FRACTION				
Probe Wash ID	DA 0128	DA 0129	DA 0130	
Beaker ID	5-07	6-07	7-07	
Liquid Volume (mL)	85	80	80	100
Initial Beaker Weights (g)				
Weight #1	113.1812	108.9414	108.0930	
Weight #2	113.1815	108.9419	108.0925	
Average Initial Weight (g)	113.1814	108.9417	108.0928	0.0000
Final Beaker Weights (g)				
Weight #1	113.1958	108.9579	108.1010	
Weight #2	113.1954	108.9576	108.1007	
Average Final Weight (g)	113.1956	108.9578	108.1009	0.0000
Final-Initial Beaker Wts. (g)	0.0142	0.0161	0.0081	0.0000
Sample/Blank Volume Ratio	0.8500	0.8000	0.8000	
Liquid Blank Correction (g)	0.0000	0.0000	0.0000	
Liquid Particulate Weight (g)	0.0142	0.0161	0.0081	0.0000
FILTER FRACTION				
Filter ID	DA 0128	DA 0129	DA 0130	0.0000
Initial Filter Weights (g)				
Weight #1	36.3354	37.5069	36.6629	
Weight #2	36.3355	37.5069	36.6630	
Average Initial Weight (g)	36.3355	37.5069	36.6630	0.0000
Final Filter Weights (g)				
Weight #1	36.3394	37.5110	36.6665	
Weight #2	36.3397	37.5113	36.6667	
Average Final Weight (g)	36.3396	37.5112	36.6666	0.0000
Final-Initial Filter Wts. (g)	0.0041	0.0043	0.0036	0.0000
Filter Blank (g)	0.0000	0.0000	0.0000	
Filter Particulate Weight (g)	0.0041	0.0043	0.0036	
SUMMARY				
Filter Particulate Weight (g)	0.0041	0.0043	0.0036	
Liquid Particulate Weight (g)	0.0142	0.0161	0.0081	
Net Particulate Weight (g)	0.0183	0.0204	0.0117	

Sample Recovery Solution

Water

Weight Percent of Blank

0.0000%

Liquid Fraction

Note: If the blank liquid fraction has a residue weight percent of greater than 0.001 percent, then the samples are not blank corrected.

ISOKINETIC FIELD DATA SHEET

BORATE

① 39117-④ 08.④13

Method

	Stack Conditions	Assumed	Actual	Meter Box ID	Meter Box Y	Leak Checks
W.O.#	% Moisture	2.6	2.57	Meter Box Del H	1.936	Sample Train (ft)
Project ID	# REC BLT	Impinger Vol (ml)	9.6	Probe ID / Length	Aug 60 10	Leak Check @ (in Hg)
Model/Source ID	STACK	Silica gel (g)	4.5	Probe Material	SS	
Samp. Loc. ID	0112	CO2, % by Vol	14.1	Pilot / Thermocouple ID	7-176	Pilot good
Run No.ID	5	O2, % by Vol	5.2	Pilot Coefficient	.87	Orsat good
Test Method ID	23 JUL 98	Temperature (°F)		Nozzle ID	-274	Temp Check
Date ID	CATAOGA, SC	Meter Temp (°F)		Avg Nozzle Dia (in)	-274	Meter Box Temp
Source/Location	3333 NTL & 8	Meter Temp (°C)		Reference Temp		
Sample Date	29	Static Press (in H2O)	-.62	Pass/Fail (+/- 2°)	64	
Baro. Press (in Hg)	1013	Area of Stack (ft)	~40	Temp Change Response?	116	
Operator	R23 / R1P	Ambient Temp (°F)	75	Total Traverse Pts	5	

K Factor	Initial	Mid-Point	Final
.DL 2	1.936		
15			
(S) / no	yes / no		
(S) / no	yes / no		
Pre-Test Set	Post-Test Set		
75			
(S) / Fail	Pass / Fail		
(S) / no	yes / no		

TRAVERSE POINT NO.	SAMPLE TIME (min)	CLOCK TIME (min:sec)	VELOCITY PRESSURE DATA P(t) (in H2O)	DRY GAS METER READING (ft)	STACK TEMP (°F)	DGM INLET TEMP (°F)	NOSE OUTLET TEMP (°F)	PROBE TEMP (°F)	FILTER BOX TEMP (°F)	IMPINGER EXIT TEMP (°F)	SAMPLE TRAIN (AC) (in Hg)	COMMENTS	
A - 1	0	09537	4.8	1.22	713.5	340	80	250	256	640	4		
2	10	118	1.8	1.22	715.9	340	82	253	257	640	4		
3	15	113	1.1	1.22	716.2	340	83	254	262	58	4		
4	20	116	1.7	1.22	800.5	340	85	253	260	640	4		
5	25	20	50	1.30	803.0	340	87	253	260	63	4		
6	30	24	50	1.30	805.4	341	88	260	260	64	5		
7	35	28	15	1.20	808.1	341	89	253	261	65	5		
8	40	32	3.8	1.03	810.3	341	90	252	254	64	4		
B-1	45	36	1.8	1.00	812.7	340	92	242	240	64	4		
24	50	40	50	1.30	815.2	341	93	240	242	62	4		
35	55	44	149	1.30	817.7	341	94	240	242	61	5		
44	60	48	50	1.30	820.1	341	95	256	258	61	5		
5	52	48	1.30	822.6	341	96	258	253	61	5			
6	54	48	1.30	825.1	343	97	256	254	63	5			
7	60	45	1.20	827.5	343	97	253	256	63	5			
8	61	1058	3.0	9.0	829.5	92	107	98	254	256	64		
Avg Sqrd Delta P	Avg Delta H	Total Volume H	Avg Ts	Avg Dg	Avg Tm	Min/Max	Min/Max	Max Temp	Max Vac	Max Temp			
4.8	1.20	38.592	340.9	10.4	90.4				5				
	Avg Sqrd Delt H	Comments:											
		80.1											

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80.1 25.4
10.4 90.4
10.4 90.4

DA - φ 128

H2 - 100

H3 - 0

S.G. - 303.4 / 333.0

C-3

ISOKINETIC FIELD DATA SHEET

82045-2
03217.008.012

Client	Stack Conditions	Assumed	Actual	% Moisture	Impinger Vol (ml)	Meter Box ID	Meter Box Y	Leak Checks
W.O.#		26	274		5.3	Probe ID Length	1.536	Sample Train (ft ³)
Project ID	REC-BL2				5.3	Probe Material	5.5	Leak Check @ (in Hg)
Model/Source ID	SJ ACK				14.3	Pitot / Thermocouple ID	0.12	
Samp. Loc. ID	5				5.2	Pitot Coefficient	1.5	
Run No.ID	5				5.0	Nozzle ID	5.1	Pilot good
Test Method ID	23-JNL-08					Avg Nozzle Dia (in)	2.74	Orsat good
Date ID	C-A-T-A-08-08					Area of Stack (ft)	2.74	Temp Check
Source/Location	22301078					Meter Box Temp		
Sample Date	2012-09-29					Reference Temp		
Baro. Press (in Hg)	1012.95					Pass/Fail (+/- 2°)	64	
Operator						Temp Change Response?	±10	
						Pass / Fail		
						yes / no		

Method

K Factor	Initial	Mid-Point	Final
Meter Box ID	1.984		1.986
Meter Box Del H	1.536		1.536
Probe ID Length	1.496	1.49	1.496
Probe Material	5.5		5.5
Pitot / Thermocouple ID	0.12		0.12
Pitot Coefficient	1.5		1.5
Nozzle ID	5.1		5.1
Avg Nozzle Dia (in)	2.74		2.74
Area of Stack (ft)	2.74		2.74
Meter Box Temp			
Reference Temp			
Pass / Fail			
yes / no			

BAS 26.9
ISO 102.3

H3 - P
#2-106

SC - 302.9/322.2
H3 - P

139

139

Avg Sqr Delta P	Avg Delta H	Total Volume	Avg Ts	Avg Tm	Min/Max	Max Temp	Max Vac
1.29	1.22	38.499	341.1	33.4	243.242	247.245	4.3

Avg Sqr Del H	Comments:
1.29	BAS 26.9 ISO 102.3

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DESIGN CONSULTANTS

ISOKINETIC FIELD DATA SHEET

Job# 92917-0008.023

Method

5

Client	W.O.#	Stack Conditions	Assumed	Actual	Meter Box ID	Meter Box Y	K Factor	Avg 2
Project ID	92917-0008.023	% Moisture	2.6	2.6	Meter Box Del H	.996	.996	
Model/Source ID	92 RE-C SL(2)	Impinger Vol (ml)			Probe ID / Length	1.936	Leak Checks	
Samp. Loc. ID	SL4CL	Silica gel (g)			Probe Material	1.941	Sample Train (ft ³)	1.943
Run No.ID	5	CO ₂ , % by Vol	30.7	30.7	Pilot / Thermocouple ID	0.136	Leak Check @ (in Hg)	0.136
Test Method ID	TH RE-E	O ₂ , % by Vol	30.7	30.7	Pilot Coefficient	.841	Pilot good	yes / no
Date ID	23 30 14 8	Temperature (°F)			Nozzle ID	.274	Orsat good	yes / no
Source/Location	CATAN 69, S	Meter Temp (°F)			Avg Nozzle Dia (in)	.234	Temp Check	yes / no
Sample Date	23 30 14 8	Meter Temp (°F)			Meter Box Temp		Meter Box Temp	
Baro. Press (in Hg)	29.2	Ambient Temp (°F)			Reference Temp		Reference Temp	
Operator	BLA / MT P				Temp Change Response ?		Pass/Fail (+/- 2°)	

Total Traverse Pts

Sample Time

16

Pass / Fail

yes / no

TRAVERSE POINT NO.	SAMPLE TIME (MINUTES)	CLOCK TIME (MINUTES)	VELOCITY PRESSURE DELTA H (inH2O)	QUANTITY DELTA H (inH2O)	DISCERNABLE REFLECTIONS	STACK TEMP (°F)	DGM INLET TEMP (°F)	DGM OUTLET TEMP (°F)	PROBE TEMP (°F)	FLUID BOY TEMP (°F)	INDUCER EXTEMP (°F)	SAMPLE TRAIN VAC (inHg)	COMMENTS
0	4.5	4.4	1.24	0.72	87.0 88.2	341	192	254	262	43	4		
1	5.0	5.0	1.30	0.78	241	192	257	257	257	42	4		
2	5.7	4.7	1.20	0.72	340	192	260	264	264	40	4		
3	5.3	4.0	0.85	0.77	340	192	262	263	263	41	4		
4	1.6	1.40	0.88	0.74	340	192	261	263	263	40	4		
5	2.0	5.2	1.40	0.86	341	193	250	260	260	45	4		
6	2.4	5.1	1.40	0.86	341	193	252	260	260	46	4		
7	2.8	4.9	1.30	0.86	341	193	252	260	260	46	4		
8	3.2	3.2	1.40	0.81	340	193	249	255	255	46	4		
9	3.6	5.2	1.40	0.81	340	194	245	258	258	44	4		
10	4.0	5.2	1.40	0.85	340	194	261	264	264	43	4		
11	4.4	5.2	1.40	0.84	341	194	254	260	260	42	4		
12	4.8	5.4	1.40	0.90	343	195	257	262	262	42	4		
13	5.2	5.3	1.40	0.75	342	195	265	263	263	42	4		
14	5.6	5.3	1.40	0.75	342	195	265	265	265	42	4		
15	6.0	5.3	1.40	0.75	342	196	252	252	252	42	4		
16	6.4	5.3	1.40	0.75	341	196	255	262	262	42	4		
17	6.8	5.3	1.30	0.88	343	196	252	264	264	43	4		
18	7.2	3.2	1.40	0.96	340	197	251	263	263	43	4		
19	7.6	3.2	1.40	0.96	340	197	251	263	263	43	4		
20	8.0	3.2	1.40	0.96	340	197	251	263	263	43	4		
21	8.4	1.523	1.40	0.96	340	197	251	263	263	43	4		

Avg Sqr Delta P	Avg Delta H	Total Volume	Avg T _s	Avg T _m	Min/Max	Max Temp	Max Vac
1.13	1.251	10.114	340.4	107.7	245.262	255.244	5

Avg Sqr Delta H	Comments:	Comments:	Comments:
1.13	800.8	100.8	100.8

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SAMPLE RECOVERY FIELD DATA

Method 5

Client
Location/Plant

BONAWER
CATANZA, SC

W.O. # 03917.008.013
Source & Location #2 Rec BLR

Run No. ONE

Sample Date 23 JUL 08 Recovery Date 23 JUL 08

Sample I.D. DA-0128

Analyst RLJ Filter Number PA-0128

Contents	Impinger						Imp.Total	7	Total
	1	2	3	4	5	6			
Final	352	100	0					5.5	
Initial	100	100	0					303.4	
Gain	252	0	0				252	9.4	261.6

Impinger Color ✓

Labeled? Y

Silica Gel Condition ✓

Sealed? Y

Run No. TWO

Sample Date 23 JUL 08 Recovery Date 23 JUL 08

Sample I.D. DA-0129

Analyst RLJ Filter Number PA-0129

Contents	Impinger						Imp.Total	7	Total
	1	2	3	4	5	6			
Final	370	100	0					5.6	
Initial	100	100	0					302.9	
Gain	270	0	0				270	9.3	285.3

Impinger Color ✓

Labeled? Y

Silica Gel Condition ✓

Sealed? Y

Run No. THREE

Sample Date 23 JUL 08 Recovery Date 23 JUL 08

Sample I.D. DA-0130

Analyst RLJ Filter Number PA-0130

Contents	Impinger						Imp.Total	7	Total
	1	2	3	4	5	6			
Final	360	100	0					5.6	
Initial	100	100	0					300.3	
Gain	260	0	0				260	10.1	270.1

Impinger Color ✓

Labeled? Y

Silica Gel Condition ✓

Sealed? Y

Check COC for Sample IDs of Media Blanks

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Determination of Moisture Content in Stack Gases - Method 4

Client BONWATER
 Location/Plant CATANBA, SC
 Source H2 Rec BLR
 W.O. Number 03917, 048, 023

Operator JHD
 Meter Box ID A12

Date 22 Jan 88
 Meter Box Y 996

Temperature °C or °F °F

Sample Volume, ft³ or L ft³

Run Number		Sample Time (min)	Meter Volume, Vm	Meter Temp (or ambient temp for rotometer)		Meter Press, Delta H (in H ₂ O)	Impinger Volume, ml	Silica Gel Weight, g	Corrected Volume, Vm(std)	Leak Rate Check
FouR				Inlet	Outlet					Initial
	End Test	1652	935.753	N/A	101	1.0	362	320.0		Final
Baro Press., Pb (in Hg)	Start Test	1610	912.000	N/A	102	1.0	200	303.7	Moisture Volume, Vw(std)	Percent Moisture (%), BWS
29.92	Avg. or Total	42	23.753		101.5	1.0	162	6.3		26.7

Run Number		Sample Time (min)	Meter Volume, Vm	Meter Temp (or ambient temp for rotometer)		Meter Press, Delta H (in H ₂ O)	Impinger Volume, ml	Silica Gel Weight, g	Corrected Volume, Vm(std)	Leak Rate Check
				Inlet	Outlet					Initial
	End Test									Final
Baro Press., Pb (in Hg)	Start Test								Moisture Volume, Vw(std)	Percent Moisture (%), BWS
	Avg. or Total									

Run Number		Sample Time (min)	Meter Volume, Vm	Meter Temp (or ambient temp for rotometer)		Meter Press, Delta H (in H ₂ O)	Impinger Volume, ml	Silica Gel Weight, g	Corrected Volume, Vm(std)	Leak Rate Check
				Inlet	Outlet					Initial
	End Test									Final
Baro Press., Pb (in Hg)	Start Test								Moisture Volume, Vw(std)	Percent Moisture (%), BWS
	Avg. or Total									

$$Vm(\text{std}) = \frac{17.64 * Y * Vm * (Pb + (\Delta H / 13.6))}{(Tm + 460)}$$

if Tm is C° than Tm = (Tmc * 1.8) + 32

if Vm is liters than Vm = Vml * 28.32

$$Vw(\text{std}) = (0.04707 * Vwc) + (0.04715 * Wwsg)$$

$$BWS = \left(\frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) * 100$$

WHERE:

Vm(std)= Sample volume corrected to standard temp and pressure, scf or L

Vm= Actual sample volume, calculated, scf

Vml= Actual sample volume, calculated, Liters

Y= Dry gas meter calibration factor.

Pb= Barometric pressure, in. Hg

delta H= Meter pressure, in H₂O

Tm= Average temperature of meter (DGM is used) or rotometer, degrees °F

Tmc= Average temperature of meter (DGM is used) or rotometer, degrees °C

Vw(std)= Volume of water vapor at standard conditions, scf or L

Vwc= Volume of water condensed, mL

Wwsg= Weight of Silica Gel, g

Bws= Water vapor in gas stream, per cent

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Use either ft³ or liters in calculations. DO NOT MIX CUBIC FEET AND LITERS IN ANY CALCULATION.

Determination of Stack Gas Velocity - Method 2

Client BONANZER Operator RJD Pitot Coeff (Cp) .84
 Location/Plant CATAHBA, SC Date 23JUL88 Stack Area, ft² (As)
 Source D2REC BLR W.O. Number 03927.008.013 Pitot Tube/Thermo ID P-176

Run Number	<u>Four</u>		
Time	<u>1645</u>		
Barometric Press, in Hg (Pb)	<u>29.29</u>		
Static Press, in H ₂ O (Pstatic)	<u>-410</u>		
Source Moisture, % (BWS)			
O ₂ , %			
CO ₂ , %			

Cyclonic Flow Determination		Traverse Location		Leak Check good ?		Leak Check good ?		Leak Check good ?			
Delta P at 0°	Angle yielding zero Delta P	Port	Point	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)	Delta P	Source Temp, F° (Ts)		
		A	1	.49	3412						
			2	.51	3400						
			3	.51	3411						
			4	.49	3413						
			5	.50	3413						
			6	.51	3413						
			7	.50	3415						
			8	.38	3415						
		B	1	.49	3422						
			2	.49	3422						
			3	.47	3399						
			4	.51	3411						
			5	.52	3422						
			6	.49	3413						
			7	.49	3414						
			8	.35	3410						
Avg Angle		Avg Delta P & Temp									
		avg $\sqrt{\Delta P}$									
Average gas stream velocity, ft/sec.											
Vol. flow rate @ actual conditions, wscf/min											
Vol. flow rate at standard conditions, dscf/min											

$$MWd = (0.32 * O_2) + (0.44 * CO_2) + (0.28 * (100 - (CO_2 + O_2)))$$

$$MWs = (MWd * (1 - (BWS/100))) + (18 * (BWS/100))$$

$$Tsa = Ts + 460$$

$$Ps = Pb + (Pstatic/13.6)$$

$$Vs = 85.49 * Cp * \text{avg } \sqrt{\Delta P} * \sqrt{Tsa / (Ps * MWs)}$$

$$Qs(\text{act}) = 60 * Vs * As$$

$$Qs(\text{std}) = 17.64 * (1 - (BWS/100)) * (Ps/Tsa) * Qs(\text{act})$$

Comments _____

where:

MWd = Dry molecular weight source gas, lb/lb-mole.

MWs = Wet molecular weight source gas, lb/lb-mole.

Tsa = Source Temperature, absolute(°R)

Ps = Absolute stack static pressure, inches Hg.

Vs = Average gas stream velocity, ft/sec.

Qs(act) = Volumetric flow rate of wet stack gas at actual,

Qs(std) = Volumetric flow rate of dry stack gas at standard

conditions, dscf/min



TOTAL REDUCED SULFUR

Bowater
Catawba, SC

03917.008.013
No. 2 Recovery Furnace

EMISSION CALCULATIONS

	Run 1	Run 2	Run 3	Mean
Date	7/23/2008 ✓	7/23/2008 ✓	7/23/2008 ✓	---
Time Began	952 ✓	1150 ✓	1522 ✓	---
Time Ended	1121 ✓	1320 ✓	1654 ✓	---
Volumetric Flow Rate, (Qs), DSCFM	1.01E+05✓	9.95E+04✓	1.03E+05✓	1.01E+05
BWS	0.254✓	0.269✓	0.261✓	0.261
% Oxygen	5.2✓	5.0 ✓	4.9✓	5.0
Oxygen Reference Concentration, %	8.0	8.0	8.0	8.0
Production Rate, units/hr ADTP	26.63 ✓	26.55 ✓	26.48 ✓	26.55

Total Reduced Sulfur MW= 34.08

Concentration, ppm	9.73	7.74	13.10	10.19
Concentration, ppm @8%O2	8.01 ✓	6.29✓	10.6✓	8.29
Emission Rate, lb/hr	5.2✓	4.1	7.2	5.5
Emission Factor, ADTP/Hr	0.20 ✓	0.15	0.27	0.21

2Mg✓

RUN SUMMARY

Number 1

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16 Calibration Number 1

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Start Time 09:52 End Time 11:21

Average Measured TRS Conc.	9.58	ppm
Recovery No. 2	98.5	%
TRS Corrected for Recovery	9.73	ppm
Oxygen Conc.	5.2	%
Oxygen Reference Conc.	8.0	%
Oxygen Correction Factor	0.823	
TRS Corrected for Oxygen	8.01	ppm



RUN SUMMARY

Number 2

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16 Calibration Number 1

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Start Time 11:50 End Time 13:20

Average Measured TRS Conc.	7.70	ppm
Recovery No. 3	99.4	%
TRS Corrected for Recovery	7.74	ppm
Oxygen Conc.	5.0	% /
Oxygen Reference Conc.	8.0	%
Oxygen Correction Factor	0.813	
TRS Corrected for Oxygen	6.29	ppm /


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RUN SUMMARY

Number 3

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery Boiler**
Method: **16 Calibration Number 1**

Project Number: **03917.008.013**
Operator: **T. Simpkins**
Date: **23 Jul 2008**

Start Time 15:22 End Time 16:54

Average Measured TRS Conc.	12.1	ppm
Recovery No. 2	91.9	%
TRS Corrected for Recovery	13.1	ppm
Oxygen Conc.	4.9	%
Oxygen Reference Conc.	8.0	%
Oxygen Correction Factor	0.807	
TRS Corrected for Oxygen	10.6	ppm



REDUCED SULFUR FIELD DATA

Run 1

Client: Bowater
 Location: Catawba, SC
 Source: No. 2 Recovery Boiler
 Method: 16 Calibration Number 1

Project Number: 03917.008.013
 Operator: T. Simpkins
 Date: 23 Jul 2008

Time	H ₂ S		MeSH		DMS		DMDS		TRS ppm
	area	ppm	area	ppm	area	ppm	area	ppm	
09:52	13121	18.9	101	2.29	95	1.62	15	0.43	23.7
09:55	10760	17.1	11	0.74	31	0.93	25	0.56	19.9
09:58	8524	15.2	11	0.72	16	0.68	14	0.42	17.4
10:01	17575	22.0	14	0.82	28	0.89	15	0.43	24.5
10:04	2090	7.42	11	0.72	28	0.88	10	0.35	9.72
10:07	2640	8.35	25	1.11	21	0.77	16	0.44	11.1
10:10	3309	9.37	11	0.72	30	0.92	20	0.49	12.0
10:13	93	1.51	8	0.61	<2	<0.24	17	0.46	3.05
10:16	1203	5.60	10	0.71	22	0.78	<2	<0.16	7.08
10:19	208	2.29	9	0.68	20	0.75	<2	<0.16	3.72
10:22	380	3.11	14	0.82	17	0.70	24	0.54	5.72
10:25	125	1.77	9	0.65	16	0.68	9	0.32	3.74
10:28	108	1.64	3	0.37	18	0.71	19	0.49	3.70
10:31	214	2.32	7	0.58	14	0.62	12	0.39	4.30
10:34	35	0.92	7	0.58	12	0.57	13	0.40	2.86
10:37	265	2.59	4	0.45	17	0.70	13	0.39	4.52
10:40	748	4.39	9	0.65	16	0.68	<2	<0.16	5.72
10:43	3	0.26	9	0.67	26	0.86	21	0.51	2.80
10:46	67	1.29	11	0.72	12	0.58	7	0.29	3.16
10:49	385	3.13	5	0.51	12	0.58	<2	<0.16	4.22
10:52	3	0.27	5	0.47	16	0.68	21	0.51	2.44
10:55	2344	7.86	8	0.61	20	0.76	22	0.52	10.3
10:58	354	3.00	9	0.67	15	0.64	<2	<0.16	4.32
11:01	384	3.12	10	0.70	47	1.14	3	0.18	5.33
11:04	773	4.47	7	0.58	14	0.63	19	0.48	6.64
11:07	1694	6.66	8	0.62	14	0.64	<2	<0.16	7.92
11:10	13567	19.2	12	0.77	21	0.77	11	0.36	21.5
11:13	15314	20.5	15	0.85	24	0.82	79	0.99	24.1
11:15	16885	21.5	15	0.86	<2	<0.24	39	0.70	23.8
11:18	1219	5.63	9	0.67	21	0.77	29	0.60	8.27
Averages:	7.38		0.73		0.73		0.38		9.58



REDUCED SULFUR FIELD DATA

Run 2

Client: Bowater
 Location: Catawba, SC
 Source: No. 2 Recovery Boiler
 Method: 16 Calibration Number 1

Project Number: 03917.008.013
 Operator: T. Simpkins
 Date: 23 Jul 2008

Time	H ₂ S		MeSH		DMS		DMDS		TRS ppm
	area	ppm	area	ppm	area	ppm	area	ppm	
11:50	812	4.58	13	0.79	28	0.88	13	0.40	7.05
11:53	824	4.61	13	0.79	16	0.68	<2	<0.16	6.08
11:56	16972	21.6	177	3.04	<2	<0.24	26	0.56	25.7
11:59	11688	17.8	42	1.46	32	0.95	20	0.49	21.2
12:02	3112	9.08	15	0.85	24	0.82	<2	<0.16	10.8
12:05	3526	9.68	12	0.77	24	0.82	12	0.38	12.0
12:08	11644	17.8	13	0.81	34	0.98	12	0.39	20.4
12:11	1320	5.87	11	0.72	31	0.93	30	0.61	8.74
12:14	2171	7.56	9	0.67	27	0.87	16	0.45	9.99
12:17	236	2.44	7	0.57	15	0.65	32	0.62	4.90
12:20	7	0.41	10	0.69	13	0.62	9	0.33	2.37
12:23	239	2.45	7	0.56	18	0.71	27	0.58	4.88
12:26	2011	7.27	10	0.70	20	0.76	<2	<0.16	8.73
12:29	134	1.83	11	0.72	16	0.66	36	0.67	4.55
12:32	4313	10.7	12	0.78	24	0.83	5	0.24	12.8
12:35	1400	6.04	12	0.76	21	0.77	15	0.43	8.44
12:38	2429	8.01	11	0.73	20	0.76	28	0.58	10.7
12:41	409	3.23	11	0.72	21	0.77	8	0.32	5.35
12:44	3	0.26	3	0.37	18	0.71	<2	<0.16	1.34
12:47	243	2.48	7	0.58	35	0.98	5	0.25	4.54
12:50	76	1.37	9	0.64	20	0.75	<2	<0.16	2.77
12:53	656	4.11	7	0.56	20	0.76	5	0.24	5.92
12:56	1189	5.56	6	0.54	17	0.68	<2	<0.16	6.79
12:59	173	2.08	9	0.66	18	0.72	24	0.55	4.55
13:02	185	2.16	6	0.56	21	0.77	<2	<0.16	3.48
13:05	64	1.25	12	0.76	33	0.96	8	0.32	3.62
13:08	185	2.16	8	0.61	24	0.82	18	0.47	4.53
13:11	61	1.23	9	0.65	19	0.73	14	0.42	3.44
13:14	4	0.29	5	0.48	14	0.62	<2	<0.16	1.39
13:17	121	1.73	6	0.56	21	0.77	15	0.43	3.93
Averages:	5.52		0.77		0.76		0.32		7.70


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REDUCED SULFUR FIELD DATA

Run 3

Client: Bowater
 Location: Catawba, SC
 Source: No. 2 Recovery Boiler
 Method: 16 Calibration Number 1

Project Number: 03917.008.013
 Operator: T. Simpkins
 Date: 23 Jul 2008

Time	H ₂ S		MeSH		DMS		DMDS		TRS
	area	ppm	area	ppm	area	ppm	area	ppm	ppm
15:22	350	4.60	3	0.64	13	0.82	307	2.69	11.4
15:25	206	3.58	5	0.82	16	0.91	<2	<0.21	5.31
15:28	642	6.11	6	0.85	27	1.17	27	0.78	9.69
15:31	245	3.89	4	0.71	21	1.04	9	0.46	6.56
15:34	121	2.79	4	0.76	13	0.82	9	0.44	5.25
15:37	903	7.18	<2	<0.51	8	0.66	<2	<0.21	7.85
15:40	538	5.63	9	1.09	9	0.68	<2	<0.21	7.39
15:43	451	5.18	<2	<0.51	10	0.72	11	0.49	6.88
15:46	290	4.20	5	0.78	18	0.96	15	0.59	7.12
15:49	826	6.89	5	0.83	12	0.78	4	0.29	9.09
15:52	1102	7.89	31	1.98	13	0.81	<2	<0.21	10.7
15:55	633	6.08	<2	<0.51	13	0.82	4	0.28	7.45
15:58	1348	8.67	4	0.72	14	0.84	11	0.50	11.2
16:01	3315	13.2	7	0.92	24	1.12	<2	<0.21	15.3
16:04	20836	31.5	<2	<0.51	21	1.05	10	0.47	33.5
16:07	6849	18.6	8	1.02	25	1.13	12	0.52	21.8
16:10	603	5.94	7	0.94	15	0.89	13	0.54	8.83
16:13	4697	15.6	<2	<0.51	25	1.14	<2	<0.21	16.8
16:16	995	7.52	6	0.90	16	0.91	<2	<0.21	9.32
16:19	2909	12.5	6	0.90	14	0.85	8	0.44	15.1
16:21	373	4.73	7	0.93	12	0.79	11	0.49	7.44
16:24	384	4.80	9	1.05	14	0.86	8	0.43	7.57
16:27	1178	8.14	6	0.91	<2	<0.33	14	0.57	10.2
16:30	4522	15.3	<2	<0.51	19	0.98	6	0.36	17.0
16:33	6648	18.4	<2	<0.51	20	1.03	<2	<0.21	19.4
16:36	2278	11.1	7	0.94	22	1.07	<2	<0.21	13.1
16:39	3076	12.8	<2	<0.51	18	0.96	37	0.93	15.6
16:42	10020	22.3	<2	<0.51	22	1.08	7	0.41	24.2
16:45	5176	16.3	7	0.95	17	0.93	13	0.54	19.3
16:48	786	6.73	<2	<0.51	15	0.88	16	0.61	8.82
16:51	308	4.33	<2	<0.51	<2	<0.33	<2	<0.21	4.33
Averages:	9.76		0.60		0.86		0.41		12.1 ✓



RECOVERY DATA

Number 1

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery Boiler**
Method: **16**

Project Number: **03917.008.013**
Operator: **T. Simpkins**
Date: **23 Jul 2008**

Calibration Number 1 Before Run 1
Start Time 09:20 End Time 09:43

Recovery was run using H₂S

Recovery Gas to Probe, Time: 09:20

Peak Areas, mv-sec			Average	ppm
3357	3545	3610	3504	9.65

Recovery Gas to GC, Time: 09:41

Peak Areas, mv-sec			Average	ppm
3593	3604	3512	3569	9.74

Recovery 99.1%



RECOVERY DATA

Number 2

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Calibration Number 1 After Run 1 Before Run 2
Start Time 11:22 End Time 11:35

Recovery was run using H₂S

Recovery Gas to Probe, Time: 11:22

Peak Areas, mv-sec			Average	ppm
3682	3651	3747	3693	9.91

Recovery Gas to GC, Time: 11:33

Peak Areas, mv-sec			Average	ppm
3809	3804	3802	3805	10.1

Recovery 98.5%



RECOVERY DATA

Number 3

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery Boiler**
Method: **16**

Project Number: **03917.008.013**
Operator: **T. Simpkins**
Date: **23 Jul 2008**

Calibration Number 1 After Run 2 Before Run 3
Start Time 13:20 End Time 13:31

Recovery was run using H₂S

Recovery Gas to Probe, Time: 13:20

Peak Areas, mv-sec			Average	ppm
3386	3427	3395	3403	9.51

Recovery Gas to GC, Time: 13:28

Peak Areas, mv-sec			Average	ppm
3432	3437	3456	3442	9.56

Recovery 99.4%

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RECOVERY DATA

Number 1

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Calibration Number 1 Before Run 1
Start Time 15:12 End Time 15:20

Recovery was run using H₂S

Recovery Gas to Probe, Time: 15:12

Peak Areas, mv-sec			Average	ppm
1286	1493	1533	1437	8.94

Recovery Gas to GC, Time: 15:17

Peak Areas, mv-sec			Average	ppm
1498	1513	1524	1512	9.15

Recovery 97.6%

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RECOVERY DATA

Number 2

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Calibration Number 1 After Run 3 Before Run 4
Start Time 16:56 End Time 17:08

Recovery was run using H₂S

Recovery Gas to Probe, Time: 16:56

Peak Areas, mv-sec			Average	ppm
1512	1561	1430	1501	9.12

Recovery Gas to GC, Time: 17:05

Peak Areas, mv-sec			Average	ppm
1797	1785	1802	1795	9.93

Recovery 91.9%

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CALIBRATION DATA

Number 1

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Ambient Temp 72°F Baro. Press. 29.32 in. Hg

Compound	H ₂ S	MeSH	DMS	DMDS
Perm. Device ID	T30097	33-30104	19-30107	89-30115
Perm. Rate, nL/min	492	380	303	249
Ret. Time, sec	16.5	29.0	65.0	132.0
1 Flow 137 mL/min	3.59 ppm	2.78 ppm	2.22 ppm	1.82 ppm
Time: 08:45		Peak Areas, mv-sec		
	519	156	169	269
	502	146	182	254
	515	148	170	257
Average Area	512 ✓	150 ✓	174 ✓	260 ✓
2 Flow 54.5 mL/min	9.04 ppm	6.98 ppm	5.57 ppm	4.56 ppm
Time: 07:33		Peak Areas, mv-sec		
	2967	885	1280	1663
	2978	835	1251	1752
	3031	856	1285	1739
Average Area	2992 ✓	859 ✓	1272 ✓	1718 ✓
3 Flow 23.1 mL/min	21.3 ppm	16.5 ppm	13.1 ppm	10.8 ppm
Time: 06:31		Peak Areas, mv-sec		
	16780	4765	6388	9081
	16830	4763	6586	9032
	16882	4870		8914
Average Area	16831 ✓	4799 ✓	6487 ✓	9009 ✓



CALIBRATION SUMMARY

Number 1

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

H ₂ S	1	2	3		
Time	08:45	07:33	06:31		
Conc.	3.59	9.04	21.3		
Response	512	2992	16831		
Calc. Conc.	3.62	8.90	21.5		
% Error	+0.7	-1.5	+0.8		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.9612	1.6137	0.9999	2	0.21
MeSH	1	2	3		
Time	08:45	07:33	06:31		
Conc.	2.78	6.98	16.5		
Response	150	859	4799		
Calc. Conc.	2.80	6.86	16.6		
% Error	+0.8	-1.7	+0.9		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.9463	1.3063	0.9999	2	0.30
DMS	1	2	3		
Time	08:45	07:33	06:31		
Conc.	2.22	5.57	13.1		
Response	174	1272	6487		
Calc. Conc.	2.18	5.78	12.9		
% Error	-1.8	+3.9	-1.9		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	2.0344	1.5538	0.9993	2	0.24
DMDS	1	2	3		
Time	08:45	07:33	06:31		
Conc.	1.82	4.56	10.8		
Response	260	1718	9009		
Calc. Conc.	1.80	4.64	10.7		
% Error	-0.8	+1.8	-0.9		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	1.9922	1.9063	0.9999	2	0.16



PERMEATION RATE CALCULATIONS

Client: Bowater
 Location: Catawba, SC
 Source: No. 2 Recovery Boiler
 Method: 16

Project Number: 03917.008.013
 Operator: T. Simpkins
 Date: 22 Jul 2008

To calculate the permeation rate in volume units:

$$PR_{nl} = PR_{ng} \times (V_{mol} / W_{mol}) \times [(460^\circ + T_a) / T_s] \times (P_s / P_a)$$

Where:

- PR_{nl} = Permeation Rate, nL/min
- PR_{ng} = Permeation Rate, ng/min
- V_{mol} = Molar Volume of any gas @32°F & 29.92 mm Hg = 22.4 L/mole
- W_{mol} = Molecular Weight of compound
- T_a = Ambient Temperature, °F
- T_s = Standard Temperature = 492°R
- P_s = Standard Pressure = 29.92 in Hg
- P_a = Ambient Pressure, in Hg

To calculate concentration:

$$C = PR_{nl} / F_d$$

Where:

- C = Concentration, ppmv
- PR_{nl} = Permeation Rate, nL/min
- F_d = Diluent Flow Rate, mL/min

$$T_a = 72^\circ\text{F} \quad P_a = 29.32$$

$$\text{H}_2\text{S: Device T30097} \quad PR_{ng} = 679 \text{ ng/min} \quad W_{mol} = 34.08$$

$$PR_{nl} = 679 \times (22.4 / 34.08) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 492 \text{ nL/min}$$

$$\text{MeSH: Device 33-30104} \quad PR_{ng} = 740 \text{ ng/min} \quad W_{mol} = 48.11$$

$$PR_{nl} = 740 \times (22.4 / 48.11) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 380 \text{ nL/min}$$

$$\text{DMS: Device 19-30107} \quad PR_{ng} = 763 \text{ ng/min} \quad W_{mol} = 62.14$$

$$PR_{nl} = 763 \times (22.4 / 62.14) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 303 \text{ nL/min}$$

$$\text{DMDS: Device 89-30115} \quad PR_{ng} = 948 \text{ ng/min} \quad W_{mol} = 94.20$$

$$PR_{nl} = 948 \times (22.4 / 94.20) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 249 \text{ nL/min}$$

	H ₂ S	MeSH	DMS	DMDS
Permeation Device ID	T30097	33-30104	19-30107	89-30115
Permeation Rate, ng/min	679	740	763	948
Permeation Rate, nL/min	492	380	303	249



INSTRUMENT DATA

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 22 Jul 2008

File: C:\DATA\Bowater- Catawba, SC\Compliance 2008\No2 RB.trw
Computer: WSAUB61 Trailer: 231

Analog Input Device Keithley KPCMCIA 16AI Card

Sampling Rate $\frac{50}{1024}$ sec

Data Interval 0.5 sec

Gas Chromatograph Shimadzu GC-8a

Gases	Pressure psig	Flow mL/min	Temperatures	Sample Loop	5"
H ₂	30	50	Column 100°C	Column 1	Packed
Air	30	60	Detector 120°C	Column 2	none
Carrier	50	30		Detector Range	10

Injection Cycle

Length 180 sec

Valve Timing	Time, sec
Inject	0
Load/Backflush	90

Injection is triggered by internal clock

Integration Parameters

Signal threshold 0.67 mv

Peak detection window ± 10 sec

Minimum peak area 2 mv-sec Minimum peak height 1 mv above baseline

Dynacalibrator

Chamber Temperature 50.0°C

Ambient Temperature 72°F

Barometric Pressure 29.32 in. Hg



CALIBRATION DATA

Number 1

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery Boiler**
Method: **16**

Project Number: **03917.008.013**
Operator: **T. Simpkins**
Date: **23 Jul 2008**

Ambient Temp 72°F Baro. Press. 29.32 in. Hg

Compound	H ₂ S	MeSH	DMS	DMDS
Perm. Device ID	T30097	33-30104	19-30107	89-30115
Perm. Rate, nL/min	492	380	303	249
Ret. Time, sec	16.5	29.0	65.0	132.0

1 Flow 92.3 mL/min	5.34 ppm	4.12 ppm	3.29 ppm	2.69 ppm
Time: 14:53	Peak Areas, mv-sec			
	476	140	220	305
	478	140	214	312
	476	140	219	298
Average Area	477 /	140 /	217 /	305 /
2 Flow 40.7 mL/min	12.1 ppm	9.34 ppm	7.46 ppm	6.11 ppm
Time: 14:40	Peak Areas, mv-sec			
	2793	764	1198	1601
	2769	756	1172	1583
	2771	740	1203	1529
Average Area	2778 /	753 /	1191 /	1571 /
3 Flow 21.8 mL/min	22.6 ppm	17.4 ppm	13.9 ppm	11.4 ppm
Time: 14:24	Peak Areas, mv-sec			
	9953	2567	3982	5079
	10191	2673	4104	5308
	10450	2750	4243	5434
Average Area	10198 /	2663 /	4110 /	5274 /



CALIBRATION SUMMARY

Number 1

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

H ₂ S	1	2	3		
Time	14:53	14:40	14:24		
Conc.	5.34	12.1	22.6		
Response	477	2778	10198		
Calc. Conc.	5.32	12.2	22.5		
% Error	-0.3 ✓	+0.8 ✓	-0.4 ✓		
<u>Calibration Curve:</u>	<u>Slope</u>	<u>Intercept</u>	<u>Corr Coeff</u>	<u>Min Area</u>	<u>Det Lim</u>
	2.1236	1.1374	>0.9999	2	0.40
MeSH	1	2	3		
Time	14:53	14:40	14:24		
Conc.	4.12	9.34	17.4		
Response	140	753	2663		
Calc. Conc.	4.11	9.38	17.4		
% Error	-0.2 ✓	+0.4 ✓	-0.2 ✓		
<u>Calibration Curve:</u>	<u>Slope</u>	<u>Intercept</u>	<u>Corr Coeff</u>	<u>Min Area</u>	<u>Det Lim</u>
	2.0427	0.8913	>0.9999	2	0.51
DMS	1	2	3		
Time	14:53	14:40	14:24		
Conc.	3.29	7.46	13.9		
Response	217	1191	4110		
Calc. Conc.	3.27	7.54	13.8		
% Error	-0.5 ✓	+1.1 ✓	-0.6 ✓		
<u>Calibration Curve:</u>	<u>Slope</u>	<u>Intercept</u>	<u>Corr Coeff</u>	<u>Min Area</u>	<u>Det Lim</u>
	2.0387	1.2875	0.9999	2	0.33
DMDS	1	2	3		
Time	14:53	14:40	14:24		
Conc.	2.69	6.11	11.4		
Response	305	1571	5274		
Calc. Conc.	2.69	6.16	11.4		
% Error	-0.3 ✓	+0.7 ✓	-0.4 ✓		
<u>Calibration Curve:</u>	<u>Slope</u>	<u>Intercept</u>	<u>Corr Coeff</u>	<u>Min Area</u>	<u>Det Lim</u>
	1.9767	1.6358	>0.9999	2	0.21



CALIBRATION DATA

Number 2

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

Ambient Temp 72°F Baro. Press. 29.32 in. Hg

Compound	H ₂ S	MeSH	DMS	DMDS
Perm. Device ID	T30097	33-30104	19-30107	89-30115
Perm. Rate, nL/min	492	380	303	249
Ret. Time, sec	16.5	29.0	65.0	132.0

1 Flow 104 mL/min	4.74 ppm	3.66 ppm	2.92 ppm	2.39 ppm
--------------------------	-----------------	-----------------	-----------------	-----------------

<u>Time: 18:10</u>	Peak Areas, mv-sec			
463	143	190	263	
456	130	191	263	
456	137	196	256	
<u>Average Area</u>	<u>458</u> ✓	<u>137</u> ✓	<u>192</u> ✓	<u>261</u> ✓

2 Flow 40.0 mL/min	12.3 ppm	9.50 ppm	7.59 ppm	6.22 ppm
---------------------------	-----------------	-----------------	-----------------	-----------------

<u>Time: 17:47</u>	Peak Areas, mv-sec			
3901	1089	1532	2059	
3824	1082	1541	1970	
3810	1088	1524	1903	
<u>Average Area</u>	<u>3845</u> ✓	<u>1086</u> ✓	<u>1532</u> ✓	<u>1977</u> ✓

3 Flow 21.4 mL/min	23.0 ppm	17.8 ppm	14.2 ppm	11.6 ppm
---------------------------	-----------------	-----------------	-----------------	-----------------

<u>Time: 17:30</u>	Peak Areas, mv-sec			
13596	3683	5241	6582	
13946	3777	5344	6776	
14192	3917	5318	6865	
<u>Average Area</u>	<u>13911</u> ✓	<u>3793</u> ✓	<u>5301</u> ✓	<u>6741</u> ✓

CALIBRATION SUMMARY

Number 2

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

H ₂ S	1	2	3		
Time	18:10	17:47	17:30		
Conc.	4.74	12.3	23.0		
Response	458	3845	13911		
Calc. Conc.	4.70	12.6	22.7		
% Error	-0.8 ✓	+2.0 ✓	-1.2 ✓		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	2.1642	1.2070	0.9998	2	0.38
MeSH	1	2	3		
Time	18:10	17:47	17:30		
Conc.	3.66	9.50	17.8		
Response	137	1086	3793		
Calc. Conc.	3.63	9.70	17.6		
% Error	-0.8 ✓	+2.0 ✓	-1.2 ✓		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	2.1069	0.9572	0.9998	2	0.49
DMS	1	2	3		
Time	18:10	17:47	17:30		
Conc.	2.92	7.59	14.2		
Response	192	1532	5301		
Calc. Conc.	2.89	7.76	14.0		
% Error	-0.9 ✓	+2.2 ✓	-1.3 ✓		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	2.1035	1.3139	0.9997	2	0.33
DMDS	1	2	3		
Time	18:10	17:47	17:30		
Conc.	2.39	6.22	11.6		
Response	261	1977	6741		
Calc. Conc.	2.37 ✓	6.34 ✓	11.5 ✓		
% Error	-0.8 ✓	+1.9 ✓	-1.2 ✓		
Calibration Curve:	Slope	Intercept	Corr Coeff	Min Area	Det Lim
	2.0625	1.6419	0.9998	2	0.22



PERMEATION RATE CALCULATIONS

Client: Bowater
 Location: Catawba, SC
 Source: No. 2 Recovery Boiler
 Method: 16

Project Number: 03917.008.013
 Operator: T. Simpkins
 Date: 23 Jul 2008

To calculate the permeation rate in volume units:

$$PR_{nl} = PR_{ng} \times (V_{mol} / W_{mol}) \times [(460^\circ + T_a) / T_s] \times (P_s / P_a)$$

Where:

- PR_{nl} = Permeation Rate, nL/min
- PR_{ng} = Permeation Rate, ng/min
- V_{mol} = Molar Volume of any gas @32°F & 29.92 mm Hg = 22.4 L/mole
- W_{mol} = Molecular Weight of compound
- T_a = Ambient Temperature, °F
- T_s = Standard Temperature = 492°R
- P_s = Standard Pressure = 29.92 in Hg
- P_a = Ambient Pressure, in Hg

To calculate concentration:

$$C = PR_{nl} / F_d$$

Where:

- C = Concentration, ppmv
- PR_{nl} = Permeation Rate, nL/min
- F_d = Diluent Flow Rate, mL/min

$$T_a = 72^\circ\text{F} \quad P_a = 29.32$$

H₂S: Device T30097 $PR_{ng} = 679 \text{ ng/min}$ $W_{mol} = 34.08$

$$PR_{nl} = 679 \times (22.4 / 34.08) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 492 \text{ nL/min}$$

MeSH: Device 33-30104 $PR_{ng} = 740 \text{ ng/min}$ $W_{mol} = 48.11$

$$PR_{nl} = 740 \times (22.4 / 48.11) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 380 \text{ nL/min}$$

DMS: Device 19-30107 $PR_{ng} = 763 \text{ ng/min}$ $W_{mol} = 62.14$

$$PR_{nl} = 763 \times (22.4 / 62.14) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 303 \text{ nL/min}$$

DMDS: Device 89-30115 $PR_{ng} = 948 \text{ ng/min}$ $W_{mol} = 94.20$

$$PR_{nl} = 948 \times (22.4 / 94.20) \times [(460 + 72) / 492] \times (29.92 / 29.32) \\ = 249 \text{ nL/min}$$

	H ₂ S	MeSH	DMS	DMDS
Permeation Device ID	T30097	33-30104	19-30107	89-30115
Permeation Rate, ng/min	679	740	763	948
Permeation Rate, nL/min	492	380	303	249

INSTRUMENT DATA

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

File: C:\DATA\Bowater-Catawba, SC\Compliance 2008\No2 RB-2.trw
Computer: WSAUB61 Trailer: 231

Analog Input Device Keithley KPCMCIA 16AI Card

Sampling Rate $\frac{50}{1024}$ sec

Data Interval 0.5 sec

Gas Chromatograph Shimadzu GC-8a

Gases	Pressure psig	Flow mL/min	Temperatures	Sample Loop	5"
H ₂	30	50	Column 100°C	Column 1	Packed
Air	30	60	Detector 120°C	Column 2	none
Carrier	50	30		Detector Range	10

Injection Cycle

Length 180 sec

Valve Timing	Time, sec
Inject	0
Load/Backflush	90

Injection is triggered by internal clock

Integration Parameters

Signal threshold 0.67 mv

Peak detection window ± 10 sec

Minimum peak area 2 mv-sec Minimum peak height 1 mv above baseline

Dynacalibrator

Chamber Temperature 50.0°C

Ambient Temperature 72°F

Barometric Pressure 29.32 in. Hg



INSTRUMENT DATA

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery Boiler
Method: 16

Project Number: 03917.008.013
Operator: T. Simpkins
Date: 23 Jul 2008

File: C:\DATA\Bowater- Catawba, SC\Compliance 2008\No2 RB-2.trw
Computer: WSAUB61 Trailer: 231

Analog Input Device Keithley KPCMCIA 16AI Card

Sampling Rate $50/_{1024}$ sec

Data Interval 0.5 sec

Gas Chromatograph Shimadzu GC-8a

Gases	Pressure psig	Flow mL/min	Temperatures	Sample Loop Column 1	5"
H ₂	30	50	Column 100°C	Column 1	Packed
Air	30	60	Detector 120°C	Column 2	none
Carrier	50	30		Detector Range	10

Injection Cycle

Length 180 sec

Valve Timing	Time, sec
Inject	0
Load/Backflush	90

Injection is triggered by internal clock

Integration Parameters

Signal threshold 0.67 mv

Peak detection window ± 10 sec

Minimum peak area 2 mv-sec Minimum peak height 1 mv above baseline

Dynacalibrator

Chamber Temperature 50.0°C

Ambient Temperature 72°F

Barometric Pressure 29.32 in. Hg



O₂/CO₂

RUN DATA

Number 1

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery**
Calibration: **1**

Project Number: **03917.008.013**
Operator: **Simpkins**
Date: **23 Jul 2008**

Time	O2		CO2	
	mv	%	mv	%
Starting time 11:19				
for TRS and PM test run 1				
11:19:47	2071	5.2	5703	14.1
11:20:02	2068	5.2	5707	14.1
11:20:17	2072	5.2	5705	14.1
11:20:32	2070	5.2	5706	14.1
11:20:47	2070	5.2	5705	14.1
11:21:02	2071	5.2	5700	14.1
11:21:17	2076	5.2	5707	14.1
11:21:32	2078	5.2	5699	14.1
Run Avg	2072	5.2	5704	14.1



RUN DATA

Number 2

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery**
Calibration: **1**

Project Number: **03917.008.013**
Operator: **Simpkins**
Date: **23 Jul 2008**

Time	O2		CO2	
	mv	%	mv	%
Starting time 13:19 for TRS and PM tests Run2				
13:19:19	1992	5.0	5782	14.3
13:19:34	1991	5.0	5784	14.3
13:19:49	1994	5.0	5789	14.3
13:20:04	1992	5.0	5787	14.3
13:20:19	1994	5.0	5783	14.3
13:20:34	1992	5.0	5786	14.3
13:20:49	1992	5.0	5782	14.3
13:21:04	1997	5.0	5783	14.3
Run Avg	1993	5.0	5785	14.3



RUN DATA

Number 3

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery**
Calibration: **1**

Project Number: **03917.008.013**
Operator: **Simpkins**
Date: **23 Jul 2008**

Time	O2		CO2	
	mv	%	mv	%
Starting time 16:11				
Pm test run 3				
16:11:32	2002	5.0	5744	14.2
16:11:47	2000	5.0	5744	14.2
16:12:02	1997	5.0	5747	14.2
16:12:17	2000	5.0	5748	14.2
16:12:32	1995	5.0	5753	14.2
16:12:47	1997	5.0	5754	14.2
16:13:02	1997	5.0	5755	14.2
16:13:17	1999	5.0	5755	14.2
Run Avg	1998	5.0	5750	14.2

RUN DATA

Number 3

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery**
Calibration: **1**

Project Number: **03917.008.013**
Operator: **Simpkins**
Date: **23 Jul 2008**

Time	O2		CO2	
	mv	%	mv	%
Starting time 16:53				
TRS run 3 O2				
16:54:00	1940	4.9	5817	14.4
16:54:15	1938	4.9	5824	14.4
16:54:30	1944	4.9	5830	14.4
16:54:45	1946	4.9	5818	14.4
16:55:00	1946	4.9	5824	14.4
16:55:15	1945	4.9	5825	14.4
16:55:30	1949	4.9	5826	14.4
16:55:45	1952	4.9	5826	14.4
Run Avg	1945	4.9	5824	14.4

CALIBRATION ERROR

Number 1

Client: Bowater
Location: Catawba, SC
Source: No. 2 Recovery

Project Number: 03917.008.013
Operator: Simpkins
Date: 23 Jul 2008

Starting Time: 11:11

O2

Method: EPA 3A

Slope 392.1

Intercept 31.5

Standard, %	Response, mV	%	Error, %
Zero	22	0.0	0.0 ✓
10.00	3972	10.0	0.0 ✓
19.9	7825	19.9	0.0 ✓

CO2

Method: EPA 3A

Slope 398.3

Intercept 86.3

Standard, %	Response, mV	%	Error, %
Zero	61	-0.1	-0.5 ✓
10.10	4161	10.2	0.5 ✓
19.8	7947	19.7	-0.5 ✓

JP

WESTON
SOLUTIONS

CALIBRATION

Number 1

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery**

Project Number: **03917.008.013**
Operator: **Simpkins**
Date: **23 Jul 2008**

Starting Time: 11:11

O2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	22
10.0	SG 9154263	3972
19.9	CC 105613	7825

Curve Coefficients

Slope	Intercept	Corr. Coeff.
392.1 ✓	31.5 ✓	>0.9999

CO2

Method: EPA 3A
Calibration Type: Linear Regression

Calibration Results

%	Cylinder ID	Result, mv
Zero	-	61
10.1	SG 9154263	4161
19.8	CC 105613	7947

Curve Coefficients

Slope	Intercept	Corr. Coeff.
398.3 ✓	86.3 ✓	0.9999

✓

WESTON
SOLUTIONS

ANALYZER INFORMATION

Client: **Bowater**
Location: **Catawba, SC**
Source: **No. 2 Recovery**

Project Number: **03917.008.013**
Operator: **Simpkins**
Date: **23 Jul 2008**

File Name: C:\Data\Bowater- Catawba, SC\Compliance 2008\No. 2 RB bags.cem
Computer: WSAUB60 **Trailer:** 261

Analog Input Device: **Keithley KPCMCIA 16AI Card**

Channel 1

Analyte	O2
Method	EPA 3A, Using Bias
Analyzer Make, Model & Serial No.	CAI 300; IL12025
Full-Scale Output, mv	10000
Span Concentration, %	19.9

Channel 2

Analyte	CO2
Method	EPA 3A, Using Bias
Analyzer Make, Model & Serial No.	CAI 300; 1L12025
Full-Scale Output, mv	10000
Span Concentration, %	19.8





APPENDIX D

QUALITY CONTROL DATA

EQUIPMENT CALIBRATIONS

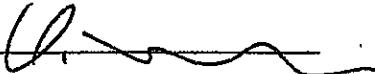
Equipment Calibrations will be maintained on file at WESTON.

PERMEATION DEVICE CERTIFICATES

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below
is certified traceable to N.I.S.T. standards.

Chemical Fill	:	Dimethyl Sulfide
Device Type	:	Standard #19
Part Number	:	117-033-6200-T33-C50-S
Length /Geometry	:	3.3 cm
Method of Certification	:	Gravimetric
Certification Number	:	19-30107
Rate	:	763 ng/min +/- 2% at 50 degrees C
Notes:		
Date	:	March 25, 2008
Customer	:	Weston Solutions
Order No.	:	M038373

By 

VICI

VICI Metronics, Inc.

26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

INDIVIDUAL DEVICE CERTIFICATION

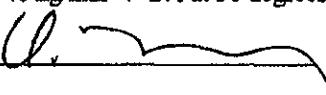
The gravimetric method measures the weight loss per unit of time at the certification temperature. Traceability is thus established by the use of temperature and weight standards traceable to N.I.S.T. standards.

Individual certification is accomplished by: (1) maintaining the device in a constant temperature chamber with a purge flow of dry nitrogen, and (2) weighing periodically on a semi-microanalytical balance, accurate to the nearest 0.01 mg, until a steady weight loss per unit time has been achieved. Temperature control and accuracy are better than $\pm 0.05^{\circ}\text{C}$, referenced against temperature standards traceable to the National Institute of Standards and Technology. The semi-microanalytical balances are routinely serviced and calibrated by an independent service organization using N.I.S.T. traceable weight standards. Gravimetric permeation rate determinations are continued until the standard error of the permeation rate meets the required accuracy at the 95% confidence level.

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below
Is certified traceable to N.I.S.T. standards.

Chemical Fill	:	Methyl Mercaptan
Device Type	:	Standard
Part Number	:	117-041-6000-C50-S
Length /Geometry	:	4.1 cm
Method of Certification	:	Gravimetric
Certification Number	:	33-30104
Rate	:	740 ng/min +/- 2% at 50 degrees C
Notes:		
Date	:	March 25, 2008
Customer	:	Weston Solutions
Order No.	:	M038373

By 

VICI

VICI Metronics, Inc.

26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

INDIVIDUAL DEVICE CERTIFICATION

The gravimetric method measures the weight loss per unit of time at the certification temperature. Traceability is thus established by the use of temperature and weight standards traceable to N.I.S.T. standards.

Individual certification is accomplished by: (1) maintaining the device in a constant temperature chamber with a purge flow of dry nitrogen, and (2) weighing periodically on a semi-microanalytical balance, accurate to the nearest 0.01 mg, until a steady weight loss per unit time has been achieved. Temperature control and accuracy are better than $\pm 0.05^{\circ}\text{C}$, referenced against temperature standards traceable to the National Institute of Standards and Technology. The semi-microanalytical balances are routinely serviced and calibrated by an independent service organization using N.I.S.T. traceable weight standards. Gravimetric permeation rate determinations are continued until the standard error of the permeation rate meets the required accuracy at the 95% confidence level.

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below
is certified traceable to N.I.S.T. standards.

Chemical Fill	:	Hydrogen Sulfide
Device Type	:	Wafer
Part Number	:	147-543-0110-C50-S
Length /Geometry	:	40T3
Method of Certification	:	Gravimetric
Certification Number	:	T-30097
Rate	:	679 ng/min +/- 2% at 50 degrees C
Notes:		
Date	:	March 25, 2008
Customer	:	Weston Solutions
Order No.	:	M038373

By 



VICI Metronics, Inc.
26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

INDIVIDUAL DEVICE CERTIFICATION

The gravimetric method measures the weight loss per unit of time at the certification temperature. Traceability is thus established by the use of temperature and weight standards traceable to N.I.S.T. standards.

Individual certification is accomplished by: (1) maintaining the device in a constant temperature chamber with a purge flow of dry nitrogen, and (2) weighing periodically on a semi-microanalytical balance, accurate to the nearest 0.01 mg, until a steady weight loss per unit time has been achieved. Temperature control and accuracy are better than $\pm 0.05^{\circ}\text{C}$, referenced against temperature standards traceable to the National Institute of Standards and Technology. The semi-microanalytical balances are routinely serviced and calibrated by an independent service organization using N.I.S.T. traceable weight standards. Gravimetric permeation rate determinations are continued until the standard error of the permeation rate meets the required accuracy at the 95% confidence level.

CERTIFICATE

The permeation rate of the DYNACAL® PERMEATION DEVICE listed below
is certified traceable to N.I.S.T. standards.

Chemical Fill	:	Dimethyl Disulfide
Device Type	:	High Emission
Part Number	:	107-200-6301-C50-S
Length /Geometry	:	20.0 cm
Method of Certification	:	Gravimetric
Certification Number	:	89-30115
Rate	:	948 ng/min +/- 2% at 50 degrees C
Notes:		
Date	:	March 25, 2008
Customer	:	Weston Solutions
Order No.	:	M038373

By 

VICI

VICI Metronics, Inc.

26295 Twelve Trees Lane NW
Poulsbo, WA 98370
(360) 697-9199 Fax: (360) 697-6682

INDIVIDUAL DEVICE CERTIFICATION

The gravimetric method measures the weight loss per unit of time at the certification temperature. Traceability is thus established by the use of temperature and weight standards traceable to N.I.S.T. standards.

Individual certification is accomplished by: (1) maintaining the device in a constant temperature chamber with a purge flow of dry nitrogen, and (2) weighing periodically on a semi-microanalytical balance, accurate to the nearest 0.01 mg, until a steady weight loss, per unit time has been achieved. Temperature control and accuracy are better than $\pm 0.05^{\circ}\text{C}$, referenced against temperature standards traceable to the National Institute of Standards and Technology. The semi-microanalytical balances are routinely serviced and calibrated by an independent service organization using N.I.S.T. traceable weight standards. Gravimetric permeation rate determinations are continued until the standard error of the permeation rate meets the required accuracy at the 95% confidence level.



CALIBRATION GAS CERTIFICATES

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E03NI80E15A0138 Reference Number: 83-124139267-32
Cylinder Number: SG9154263 Cylinder Volume: 151 Cu.Ft.
Laboratory: ASG - Port Allen - LA Cylinder Pressure: 2015 PSIG
Analysis Date: Jun 06, 2008 Valve Outlet: 590

Expiration Date: Jun 06, 2011

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	10.00 %	10.12 %	G1	+/- 1% NIST Traceable
OXYGEN	10.00 %	9.984 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	06060829	CC207986	22.51% OXYGEN/NITROGEN	May 01, 2010
NTRM	04060426	XC034407B	19.84% CARBON DIOXIDE/NITROGEN	Jul 15, 2008

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SCO2GM	NonDispersive Infrared	May 15, 2008
SO2GH	Paramagnetic	May 22, 2008

Triad Data Available Upon Request

Notes:

QA Approval

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E03NI60E15A0286 Reference Number: 113-124139028-2
Cylinder Number: CC105613 Cylinder Volume: 160 Cu.Ft.
Laboratory: ASG - Maumee - OH Cylinder Pressure: 2015 PSIG
Analysis Date: May 28, 2008 Valve Outlet: 590

Expiration Date: May 28, 2011

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	20.00 %	19.77 %	G1	+/- 1% NIST Traceable
OXYGEN	20.00 %	19.92 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	061204	CC184889	19.66% CARBON DIOXIDE/NITROGEN	May 01, 2010
NTRM	061202	CC195617	20.90% OXYGEN/NITROGEN	Jan 01, 2010

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
030-Horiba VIA-510	NDIR	May 12, 2008
050-Rosemount 755R O2 Analyzer	Paramagnetic	May 09, 2008

Triad Data Available Upon Request

Notes:

QA Approval



APPENDIX E

PROCESS OPERATING/PRODUCTION DATA

No. 2 Recovery Boiler
Process Data

Start Time	07/23/08 09:52 AM	End Time	07/23/08 04:50 PM	Steam Load	MPH	Opacity %	Black Liquor GPM	Liquor-Solids %	Oxygen %O2	TRSO ₂ ppm	TR ppm	25Al13IC.pv	25Al13IB.pv	25Al13IC.pv	25Al13IB.pv	# BL Shr	Mlbs BL/S day	Equiv. Pulp Prod ABDP/hr	
23-Jul-08 09:52:00	25613174.pv	2561321a.pv	25613085.pv	181.87	68.82	4.73	2561314,3V	15.91	11.69	80750.43	1.94	26.43							
23-Jul-08 09:58:00	311.45	2.50	182.05	68.82	4.64	15.01	80841.98	1.94	26.46										
23-Jul-08 10:04:00	304.11	2.52	182.79	68.82	4.93	6.98	81158.71	1.95	26.57										
23-Jul-08 10:10:00	285.73	2.58	182.63	68.82	5.00	4.09	81089.34	3.33	26.55										
23-Jul-08 10:16:00	273.74	2.61	182.84	68.82	4.90	4.09	81162.82	1.95	26.58										
23-Jul-08 10:22:00	273.76	2.61	182.60	68.82	4.88	3.77	81073.48	1.95	26.54										
23-Jul-08 10:28:00	280.33	2.61	182.97	68.82	4.89	3.04	81240.01	1.95	26.59										
23-Jul-08 10:34:00	288.24	2.61	182.32	68.82	4.83	2.16	80949.06	1.94	26.50										
23-Jul-08 10:40:00	304.75	2.61	182.92	68.82	4.81	4.03	81217.11	1.95	26.59										
23-Jul-08 10:46:00	297.84	2.56	184.47	68.82	4.94	4.35	81004.03	2.77	26.81										
23-Jul-08 10:52:00	286.63	2.53	184.25	68.82	5.02	3.93	81077.87	1.96	26.78	R1 PM Average	26.78								
23-Jul-08 10:58:00	277.28	2.47	184.26	68.82	6.63	6.15	81612.49	1.95	26.75										
23-Jul-08 11:04:00	317.40	2.38	184.26	68.82	4.58	13.13	8.82	81613.38	1.95	26.78									
23-Jul-08 11:10:00	273.96	2.36	184.20	68.82	4.54	12.88	10.15	81768.70	1.95	26.57									
23-Jul-08 11:16:00	267.05	2.49	183.59	68.82	4.74	7.21	6.34	81512.79	1.95	26.68									
23-Jul-08 11:22:00	282.31	2.81	183.00	68.82	4.54	7.07	12.05	81252.39	1.95	26.60	R1 TRS Average	26.63							
23-Jul-08 11:28:00	282.31	3.09	183.18	68.82	4.51	15.35	81332.63	1.95	26.63										
23-Jul-08 11:34:00	289.67	3.16	183.62	68.82	4.47	14.15	9.78	81494.07	1.95	26.67									
23-Jul-08 11:40:00	289.72	3.10	184.17	68.82	4.43	20.83	17.56	81773.25	1.95	26.77									
23-Jul-08 11:46:00	281.90	2.98	183.59	68.82	4.80	12.46	10.48	81329.73	1.95	26.62									
23-Jul-08 11:52:00	271.33	2.72	182.17	68.82	4.60	10.67	7.49	81148.65	1.95	26.57									
23-Jul-08 11:58:00	279.77	2.40	182.27	68.82	4.58	11.37	9.00	81256.73	1.95	26.45									
23-Jul-08 12:04:00	283.75	2.38	181.39	68.82	4.48	10.39	6.68	80805.45	1.94	26.54									
23-Jul-08 12:10:00	286.49	2.33	182.61	68.82	4.55	6.51	81077.14	1.95	26.54										
23-Jul-08 12:16:00	278.61	2.12	182.72	68.82	4.54	5.87	4.64	81126.31	1.95	26.96									
23-Jul-08 12:22:00	284.51	1.98	182.30	68.82	4.55	3.74	2.42	80941.94	1.94	26.50									
23-Jul-08 12:28:00	286.12	1.92	182.82	68.82	4.52	4.49	3.54	81174.03	1.95	26.57									
23-Jul-08 12:34:00	288.32	1.94	182.74	68.82	4.71	4.30	3.94	81137.98	1.95	26.55									
23-Jul-08 12:40:00	290.16	1.95	182.96	68.82	4.76	3.19	2.55	81146.65	1.95	26.57									
23-Jul-08 12:46:00	283.75	2.02	182.56	68.82	4.81	2.51	2.21	81058.16	1.95	26.54									
23-Jul-08 12:52:00	310.71	2.08	182.90	68.82	4.83	3.94	3.04	81206.30	1.95	26.58									
23-Jul-08 12:58:00	277.78	2.08	182.74	68.82	4.74	4.57	3.65	81155.88	1.95	26.55									
23-Jul-08 13:04:00	286.33	2.14	182.88	68.82	4.71	2.30	1.81	81198.30	1.95	26.58									
23-Jul-08 13:10:00	301.13	2.18	182.69	68.82	4.76	4.87	3.20	81112.61	1.95	26.55									
23-Jul-08 13:16:00	297.59	2.17	182.76	68.82	4.94	2.74	2.51	81145.05	1.95	26.56									
23-Jul-08 13:22:00	290.30	2.17	182.12	68.81	4.76	4.42	3.39	80841.35	1.94	26.46									
23-Jul-08 13:28:00	284.67	2.16	182.40	68.80	4.44	6.45	5.05	80985.70	1.94	26.50									
23-Jul-08 13:34:00	275.42	2.15	183.11	68.79	4.58	9.75	8.85	81269.73	1.95	26.60									
23-Jul-08 13:40:00	240.13	2.15	182.89	68.78	4.40	12.78	10.00	81174.56	1.95	26.58									
23-Jul-08 13:46:00	284.40	2.08	183.59	68.77	4.42	10.94	13.02	81449.31	1.95	26.66									
23-Jul-08 13:52:00	307.09	2.03	183.35	68.76	4.53	14.04	10.27	81333.89	1.95	26.63									
23-Jul-08 13:58:00	281.59	2.04	183.28	68.76	4.53	14.27	11.26	81296.11	1.95	26.61									
23-Jul-08 14:04:00	274.74	2.12	183.00	68.74	4.51	7.37	6.16	81152.03	1.95	26.57									
23-Jul-08 14:10:00	275.30	2.12	183.82	68.73	4.83	3.37	2.70	81273.91	1.95	26.61									
23-Jul-08 14:16:00	283.75	2.17	183.35	68.71	4.73	4.25	2.80	81487.14	1.95	26.58									
23-Jul-08 14:22:00	302.58	2.30	183.87	68.70	4.47	8.36	6.02	81449.31	1.95	26.66									
23-Jul-08 14:28:00	284.40	2.08	183.59	68.77	4.42	10.94	8.36	81333.89	1.95	26.63									
23-Jul-08 14:34:00	302.04	2.35	183.25	68.69	4.59	12.21	9.65	81201.31	1.95	26.58									
23-Jul-08 14:40:00	287.49	2.37	182.55	68.68	4.79	14.86	8.82	8166.59	1.95	26.47									
23-Jul-08 14:46:00	282.30	2.49	184.07	68.57	4.72	12.23	9.75	81526.10	1.95	26.62									
23-Jul-08 14:52:00	276.85	2.61	183.85	68.66	4.59	4.18	3.07	81344.81	1.95	26.63									
23-Jul-08 14:58:00	286.21	2.74	183.44	68.56	4.42	6.22	4.87	81226.38	1.95	26.59									
23-Jul-08 15:04:00	269.89	2.78	183.40	68.65	4.61	7.04	5.10	81024.15	1.95	26.61									
23-Jul-08 15:10:00	294.73	2.93	183.64	68.63	4.74	4.97	3.97	81308.00	1.95	26.62									
23-Jul-08 15:16:00	289.88	2.63	183.20	68.59	4.58	4.78	3.66	81487.14	1.95	26.54									
23-Jul-08 15:22:00	309.05	2.85	183.34	68.54	4.76	8.38	7.38	81063.07	1.95	26.45									
23-Jul-08 15:28:00	302.34	2.76	182.85	68.53	4.59	5.35	4.73	81676.79	1.95	26.45									
23-Jul-08 15:34:00	284.42	2.42	183.83	68.52	4.72	3.25	10.51	81505.56	1.95	26.52									
23-Jul-08 15:40:00	289.55	2.85	182.87	68.51	4.46	15.53	12.23	81325.10	1.95	26.47									
23-Jul-08 15:46:00	277.08	2.48	182.97	68.51	4.46	14.86	11.26	81072.81	1.94	26.59									
23-Jul-08 15:52:00	286.21	2.74	183.44	68.56	4.42	6.22	4.87	81214.15	1.95	26.56									
23-Jul-08 15:58:00	285.43	2.65	183.17	68.55	4.45	5.96	3.40	81005.53	1.94	26.52									
23-Jul-08 16:04:00	280.03	2.63	183.09	68.54	4.78	7.99	6.02	81060.00	1.94	26.50									
23-Jul-08 16:10:00	289.88	2.49	183.34	68.53	4.59	2.77	2.19	81057.50	1.95	26.54									
23-Jul-08 16:16:00	280.85	2.35	183.25	68.52	4.68	8.82	7.38	80873.07	1.94	26.45									
23-Jul-08 16:22:00	272.76	2.40	183.45	68.53	4.73	10.51	8.02	8166.59	1.95	26.45									
23-Jul-08 16:28:00	254.08	2.82	183.83	68.52	4.72	15.53	12.18	81000.95	1.94	26.52									

No. 2 Recovery Boiler
EP Data

	N-1	25ev109b.pv Kv	25ea109a.pv Ma	25ev110b.pv Kv	25ea110a.pv Ma	N-2	25ev111b.pv Kv	25ea111a.pv Ma	N-3	25ev112b.pv Kv	25ea112a.pv Ma	S-1	25ev113b.pv Kv	25ea113a.pv Ma	S-2	25ev114b.pv Kv	25ea114a.pv Ma	S-3
23-Jul-08 09:52:00	22.11	1577.46	Good Data For	836.93	40.95	836.46	836.22	40.02	836.06	622.03	40.74	687.85	39.49	812.78	812.70	811.19	812.86	813.00
23-Jul-08 10:07:00	22.30	1594.38	Good Data For	836.74	41.07	835.97	835.65	41.15	835.97	593.59	41.09	687.77	39.60	811.19	812.70	811.19	812.77	813.00
23-Jul-08 10:22:00	21.54	1599.67	Good Data For	837.65	40.95	835.97	835.73	40.99	835.73	560.47	41.33	689.27	39.62	812.86	812.86	811.44	812.86	813.00
23-Jul-08 10:37:00	21.36	1580.03	Good Data For	839.60	40.93	835.48	836.71	40.93	835.48	603.54	41.12	688.82	39.48	813.00	813.00	811.44	812.86	813.00
23-Jul-08 10:52:00	22.17	1574.45	Good Data For	834.21	40.91	835.31	835.61	40.91	835.31	642.06	40.97	688.56	39.36	813.15	813.15	811.30	812.77	813.00
23-Jul-08 11:07:00	22.06	1578.40	Good Data For	835.61	40.91	836.13	835.24	40.78	835.75	604.44	40.67	688.61	39.32	813.30	813.30	811.44	812.86	813.00
23-Jul-08 11:22:00	22.16	1570.88	Good Data For	836.80	40.91	836.87	835.58	40.90	836.89	679.20	40.58	687.85	39.33	813.59	813.59	811.55	812.86	813.00
23-Jul-08 11:37:00	21.62	1550.98	Good Data For	835.24	40.78	835.75	837.57	40.90	836.89	687.63	40.54	687.63	39.49	811.01	811.01	811.34	812.43	813.00
23-Jul-08 11:52:00	22.51	1567.58	Good Data For	837.57	40.90	836.89	836.89	40.90	836.89	687.96	41.04	687.96	39.42	811.55	811.55	811.55	812.43	813.00
23-Jul-08 12:07:00	21.89	1570.84	Good Data For	836.68	41.13	836.77	837.52	41.14	836.20	603.70	40.82	687.42	39.53	811.34	811.34	811.34	812.43	813.00
23-Jul-08 12:22:00	21.82	1563.98	Good Data For	837.52	41.14	835.64	839.03	40.91	835.64	530.83	41.02	687.69	39.51	812.43	812.43	811.55	812.43	813.00
23-Jul-08 12:37:00	21.86	1597.36	Good Data For	839.03	40.91	836.66	836.99	40.91	836.66	562.30	41.04	687.96	39.42	811.55	811.55	811.55	812.43	813.00
23-Jul-08 12:52:00	21.69	1594.51	Good Data For	836.99	40.91	838.35	837.17	40.90	838.35	598.94	41.15	688.71	39.36	810.90	810.90	811.62	812.43	813.00
23-Jul-08 13:07:00	21.82	1577.89	Good Data For	837.17	40.90	838.35	835.35	40.90	836.00	581.12	40.94	687.40	39.33	811.62	811.62	811.62	812.43	813.00
23-Jul-08 13:22:00	22.02	1564.28	Good Data For	835.35	40.90	836.97	835.79	40.69	836.97	631.94	40.60	687.72	39.24	811.13	811.13	810.17	812.43	813.00
23-Jul-08 13:37:00	21.29	1541.27	Good Data For	837.31	40.87	836.81	837.31	40.87	836.81	669.15	40.41	688.38	39.35	809.59	809.59	809.59	810.17	813.00
23-Jul-08 13:52:00	22.46	1568.79	Good Data For	838.43	40.93	837.37	837.37	40.11	837.37	650.47	40.64	689.43	39.35	810.90	810.90	810.90	812.43	813.00
23-Jul-08 14:07:00	22.13	1579.24	Good Data For	837.20	40.95	835.60	835.35	40.90	835.60	598.24	40.80	687.55	39.40	810.98	810.98	810.98	812.43	813.00
23-Jul-08 14:22:00	22.13	1570.74	Good Data For	834.95	40.73	835.29	835.79	40.87	835.91	537.05	40.91	689.03	39.30	812.51	812.51	811.47	812.43	813.00
23-Jul-08 14:37:00	20.90	1580.76	Good Data For	836.97	40.69	836.97	836.97	40.87	836.97	536.57	40.91	689.03	39.30	810.98	810.98	810.98	812.43	813.00
23-Jul-08 14:52:00	22.22	1599.15	Good Data For	835.62	40.87	835.90	835.90	40.87	835.90	536.57	40.91	689.03	39.30	812.43	812.43	811.47	812.43	813.00
23-Jul-08 15:07:00	21.96	1586.66	Good Data For	836.14	40.87	836.65	836.65	40.85	836.65	536.57	40.91	689.03	39.30	810.98	810.98	810.98	812.43	813.00
23-Jul-08 15:22:00	21.80	1580.85	Good Data For	837.78	40.85	836.64	836.64	40.72	836.67	537.05	40.91	689.03	39.30	812.51	812.51	811.47	812.43	813.00
23-Jul-08 15:37:00	22.16	1569.15	Good Data For	836.64	40.72	836.67	836.67	40.72	836.67	622.20	40.73	688.38	39.28	812.93	812.93	811.47	812.43	813.00
23-Jul-08 15:52:00	22.33	1562.90	Good Data For	836.52	40.75	836.27	836.52	40.75	836.27	654.25	40.66	689.03	39.14	810.90	810.90	810.90	812.43	813.00
23-Jul-08 16:07:00	22.48	1563.05	Good Data For	837.95	40.84	835.88	838.34	40.88	835.48	635.20	40.48	689.03	39.16	810.90	810.90	810.90	812.43	813.00
23-Jul-08 16:22:00	22.39	1569.81	Good Data For	838.34	40.88	835.48	835.48	40.88	835.48	624.90	40.51	689.03	39.22	811.26	811.26	811.26	812.43	813.00

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